Concrete

Vol. 31 Chicago, August, 1927 No. 2

Proportioning Concrete Aggregates by Weight*

A Discussion of the Advantages of Measuring Aggregates by Weight—Iowa's Experience with This Method on State Highway Work — Experiments on Weight and Volume Measurements Compared

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IT has been demonstrated by numerous investigators that the strength of concrete depends upon the relation between the amount of cement in a unit volume and the total amount of solids in that volume. The weights of the materials are proportional to the volumes of solid material in the concrete, and it is therefore logical to express proportions by weight. Expressing proportions by weight also greatly facilitates computations of quantities of materials and the design of equivalent mixtures from dissimilar materials.

Measurement by Weighing Results in Accurate Proportioning

If the fine and coarse aggregates in concrete are to bear a definite relation to each other, the advantages of weighing the aggregates, instead of measuring them, are obvious. Weighing provides a means of securing accurate quantities of materials for each batch, without the necessity of taking into account the bulking effect of moisture as in loose volumetric measure, and without additional cost. The contractor as well as the state has an accurate record of the actual amount of material used. The concrete is more uniform in quality, and the inspector can more easily control the measuring and mixing operations and make changes in quantities when necessary. Experience in Iowa with some 40 installations gives very convincing evidence that the equipment needed is inexpensive, easily installed, and can be rapidly operated.

The primary objective in measuring the ingredients for concrete by any method of measurements is to maintain definite and constant relationships between the constituents of successive batches. Accurate volumetric measurement may be possible, but in actual practice even with first-class inspection, accuracy equal to that of weighing cannot be attained without extreme vigilance and expenditure of time. It has been found easily possible to weigh consistently to 5 pounds or less. In an ordinary five-bag batch of 1:2:3½ concrete this means a possible error of 0.3 per cent. If measured by volume in a straight-sided box having an area of 6 square feet, a variation of 1 inch in height in filling the box means a possible error of 3.5 per cent.

Weighing Aggregate Advantageous from Viewpoint of Both Engineer and Contractor

The relative accuracy of the measuring method is, however, not the most vital factor. Even if the materials should be accurately measured by volume, changes in the moisture content of the sand might make relatively large changes in the batch. A large amount of research has been devoted to study of the bulking effect of moisture in sand and means of making corrections when measuring sand, but it is still common practice to ignore this factor where concrete is made in large quantities. The simplest solution is to weigh the materials and do away with the problem. The effect of moisture upon weight is very small as compared to its effect upon bulk, and the weight can be very quickly and easily corrected for the amount of moisture present.

Figure 1 shows the typical effect of moisture upon the bulk of sand. This effect is sufficient to produce an appreciable variation from theoretical proportions on practically every job where volumetric proportioning is used. Assuming that a 1:2:3½ mixture of dry materials measured by volume would require 1.42 barrels of cement per cubic yard to make concrete of 80 per cent density. If the sand used should contain 2 per cent of moisture, the cement content would be increased to 1.506 barrels per cubic yard—an increase of 6 per cent. Now if the materials were to be weighed instead of measured by volume, the same result would be secured with dry materials, but with sand containing 2 per cent moisture the cubic yard of concrete would contain 1.43 barrels of cement, an increase of only 0.06 per cent. In other words, 2 per cent of moisture in the sand means an increase in the cost of cement, which is ten times larger when the materials are measured by volume than when they are measured by weight. Even this small increase could be lowered by correcting the batch weights for the moisture content.

Of course, if proportions are based upon dry materials, any change in moisture with volumetric measurements will result in richer concrete, and hence the procedure

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*From *Public Roads*.

may be safe, but there is a big advantage in uniformity, and at least the contractor will recognize the advantage of not having the cement overrun the estimated quantity. The practice in Iowa is to run moisture determinations about six times a day or oftener and correct the batch weights accordingly.

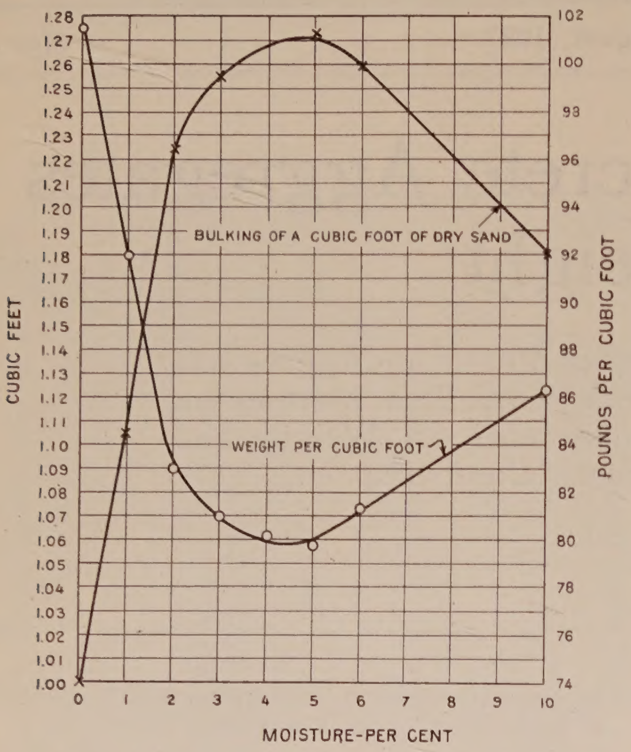


Fig. 1. Typical curves illustrating effect of moisture on bulking of sand

One of the most serious criticisms of our concrete pavement work is the lack of uniformity in the quality of the concrete. There are, of course, a number of factors upon which the uniformity depends. Undoubtedly the accuracy of measurement of the various ingredients is one factor of major importance, and although improvement in this one thing will not entirely solve the problem, no solution can be had until the materials are measured with uniform accuracy.

Change in Practice in Iowa Results in More Uniform Concrete

The Iowa Highway Commission has for several years studied the composition of the concrete in the roads by making sieve analyses of samples taken once each day from the road while yet wet. The cement is removed by washing and the aggregate remaining is dried and screened. Figure 2 shows these sieve analyses plotted for each day's run through a paving operation in 1921, and is typical of results secured by volumetric measurements, under first-class inspection.

According to the specifications, the mixture should have contained 34 per cent of fine aggregate. The fine aggregate or sand is that part passing the No. 4 sieve having 0.185 inch square openings. As shown by the diagram (Fig. 2) the proportions of the sand in the mixes actually passing the No. 4 sieve ranged from 18 to 50 per cent. Figure 3 is typical of results obtained since weighing was introduced in 1924. It will be observed that the sand content ranges only from 30 to 41 per cent. This is not perfect, but is undoubtedly an improvement. Figure 4 shows the maximum and minimum sand content of concrete during a season's work on a number of jobs, some of which proportioned by volume, and others by weighing.

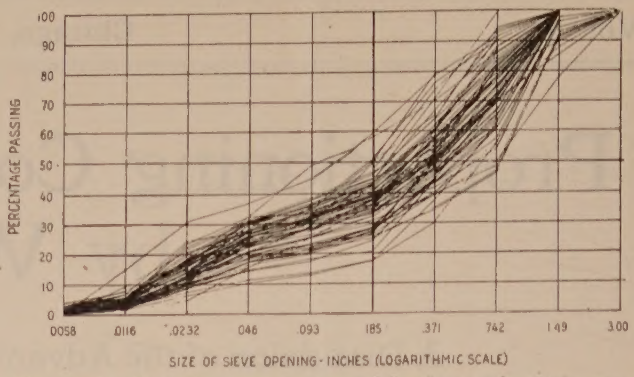


Fig. 2. Grading of aggregate on a job where volumetric proportioning was used. Samples were taken daily from the concrete after placing and the cement removed by washing

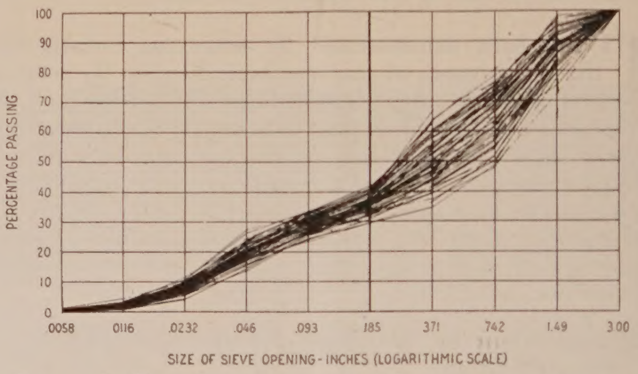


Fig. 3. Grading of aggregate on a job where materials were proportioned by weight. Samples were taken daily from the concrete after placing and the cement removed by washing

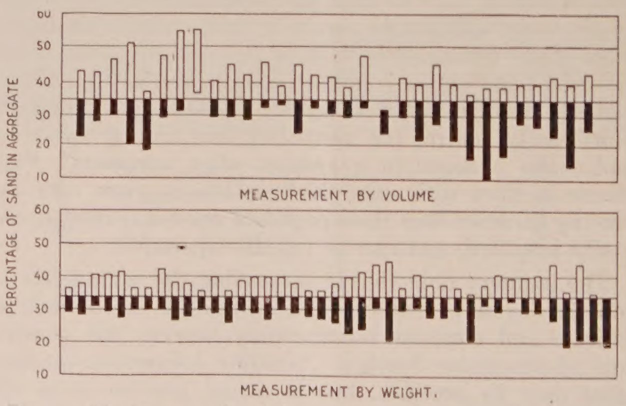


Fig. 4. Maximum and minimum percentage of sand in total aggregate during a season's run on a number of jobs, some of which proportioned by volume (prior to 1924) and some by weight. Samples were taken daily and each bar represents the extreme variation on one job. In all cases the specification required approximately 34 per cent sand in the aggregate

Proportioning by weight rather than volume avoids errors due to bulking and permits of easy correction for weight of moisture and thus reduces overrun in cement and aggregates due to these factors—or, in other words, makes the yield more uniform. The estimated quantities of cement and aggregates are usually based upon dry materials, and therefore, in measuring by volume, moisture, especially in the sand, will increase the cement per cubic yard and decrease the yield. In weighing, however, accurate batches can be produced and the yield per barrel of cement kept more constant. Our experience is as follows:

Out of 41 contracts during the period from 1920 to 1923, with aggregates measured by volume, the maximum average overrun in cement for a season's work on one job was 10.8 per cent, the greatest underrun was 1.8 per cent, and the average for all jobs was 2 per cent overrun. Out of 23 contracts during 1924 and 1925, with aggregates weighed, the maximum overrun in cement was 3.6 per cent, the minimum 0.3 per cent, and the average for all jobs was 1.8 per cent. Variations in slab thickness will always cause variations in recorded cement content per unit of volume and under rigid inspection the tendency will be to overrun. Data for 1926 are not shown for the reason that on account of the extraordinarily wet season, most of the contracts showed an unusually large overrun in materials, due to great difficulty in preparing subgrade. It would appear from the above data, which are shown graphically in Figure 5, that some improvement in uniformity was made.

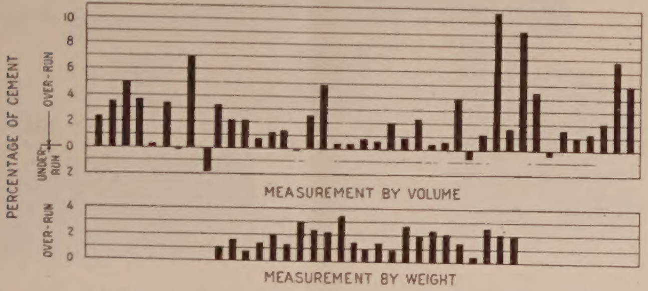


Fig. 5. Variation in use of cement from theoretical requirement on jobs proportioning by volume (prior to 1924) and by weight. Each bar represents a season's work with one mixer

A valuable result of the weighing of materials is the accurate record of the amount of material actually used in the structure which is obtained. Since such materials are customarily bought and sold by weight such a record should be of great value, especially to the contractor. At several times in the past few years settlements between the highway commission, contractors, material producers, and carriers would have been greatly facilitated had such a record been available. In one case, a paving contractor was billed for sand and gravel and freight at such a rate that every cubic yard of concrete he made would have contained 3,900 pounds of sand and gravel. In the proportions specified, this would have meant the production of concrete of 105 per cent density. The producer of the material recognized this absurdity and settled for a more reasonable amount, but this settlement was on a guess and not based on facts as it would have been had the material been weighed when mixed.

Strength of Concrete Proportioned by Two Methods Investigated

There is no question but that the realization of the foregoing contractual advantages will result in closer bidding and reduction in cost to the public. Any reductions in construction uncertainties are bound to have this effect. The method is, therefore, justified without reference to the quality of the concrete. However, since it must be admitted that accurate and uniform measurement of materials is the basis of uniform concrete, some improvement in uniformity of concrete by means of weight measurements should result. Examination of the tests of cylinders made from day to day upon the paving jobs indicates this improvement to a limited extent only. The same range of strengths in individual specimens appears on the weighed aggregate jobs as on those in which the aggregates were measured by volume. However, comparison of the average strengths of all of the different jobs from 1921 to 1926 indicates that the job averages on weighing jobs are more uniform. This conclusion is supported by the data shown in Figure 6. Also the percentage of specimens from the various jobs falling within 20 per cent of the average strength appears to be the more uniform for the weighed-aggregate jobs.

It would appear from study of these data that there must be some other variation in measurement that affects the uniformity of the strength. With the cement and aggregates accounted for, it is obvious that in order to secure the full benefit of the improved methods described, refinement must be made in the control of the water content of the batches. Data from many sources have established that the relation between water, cement, and strength may be expressed by a curve of the form shown in Figure 7. Since concrete of comparatively high strength is used on concrete paving work, reference to the curve for strengths from 3,000 pounds per square inch up will demonstrate forcibly that on such work the effect upon strength of a comparatively small variation in water content is very large.

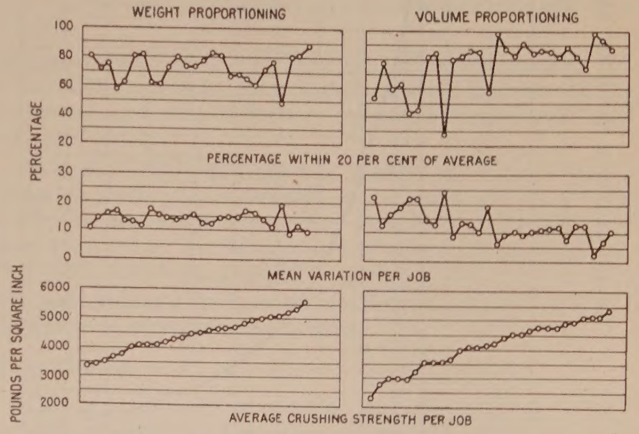


Fig. 6. Results of compression tests of cylinders made daily on a number of jobs, some of which proportioned by weight and some by volume. Each point plotted is based upon a season's work with one mixer

Special investigations were made on two jobs where the aggregates were accurately weighed and the water-measuring devices were considerably better than ordinary, with the rather astonishing result that we found a variation in water-cement ratio in fresh concrete of from 0.684 to 1.072 cubic foot of water per bag of cement in one case and from 0.648 to 0.959 cubic foot per bag in the other. According to data published by Abrams, Talbot, and others, this variation in water-cement ratio would easily account for variation in strength of 100 per cent. The mixer operator and the inspector were trying to maintain a uniform consistency while the observations were made. About seven samples per day were taken for three days. The engineer who made this investigation reported that carelessness in handling cement was a considerable factor in this variation. It is evident that more accurate methods for controlling the water-cement ratio must be developed, if we are to realize the maximum benefits from other refinements such as weight proportioning.

Weighing Found to Be a Practical Method

There have proven to be no practical difficulties in handling aggregates by weight. The equipment cost is negligible and the time element is not a factor. The rate of production has not been influenced by this method of weighing. The best evidence of the advantage to the contractor is the unanimous approval given by the contractors who have worked under this system for three years. This was recently expressed at a meeting of the paving section of the central branch of the Associated General Contractors of America. The weighing of aggregates has been standard practice in Iowa for three years and is far past the experimental stage.

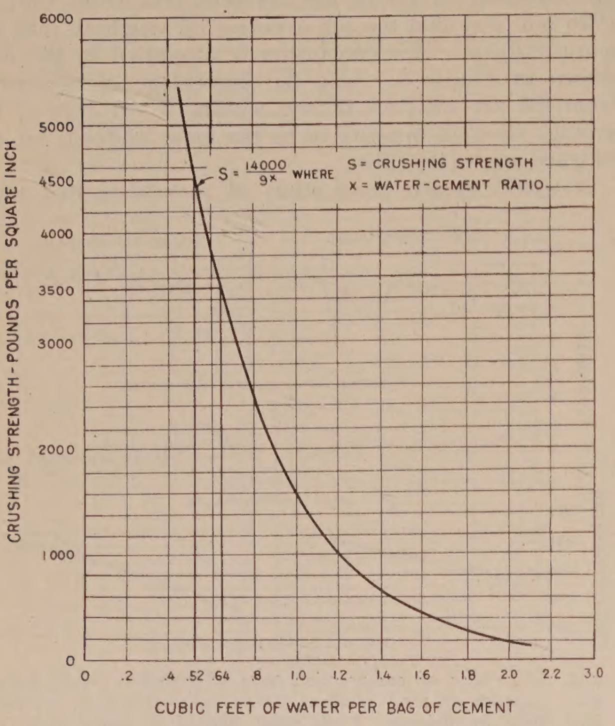


Fig. 7. Typical relation between water-cement ratio and crushing strength of concrete. An increase of 0.12 *cubic foot or* 0.9 *gallon of water per bag of cement lowers the strength of the concrete with a strength of* 4,500 *pounds per square inch to* 3,500 *pounds per square inch*

Types of Apparatus

Several varieties of weighing apparatus have been successfully used. Simple field-built bins and hoppers used with ordinary platform or mill scales have been used as well as permanent equipment designed and built by manufacturers of paving equipment.

Four general types are in use, as follows:

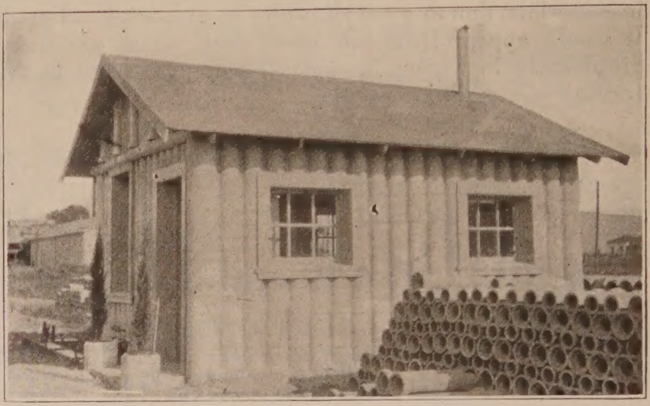
1. Bottom-dumping hopper on lever-weighing system with direct reading dial scale.
2. Batcher device adapted to weighing system, usually with pipe lever scales.
3. Bottom or side dumping hopper on platform scales.
4. Hopper mounted on movable scales for loading industrial railway boxes.

In the experience of the Iowa Highway Commission those installations have been found most satisfactory which are so arranged that the scale beam and operator are at the same elevation as the weighing hopper, so that the operator can observe the inside of the hopper and easily remove excess material if necessary.

The operation of a weighing plant, of course, involves thorough inspection. It is the inspector's duty to make sure that the scales are always in proper working order, to calibrate them frequently, and to see that the correct amount of material goes into each batch. The latter point involves frequent determinations of the moisture content of the aggregate and making the necessary corrections.

It would seem, since the weighing method provides a more accurate means of securing the specified amounts of materials in every batch, thereby removing one obstacle to the production of more uniform concrete, and since this can be done without extra cost, that we are justified in requiring this procedure. In the opinion of the Iowa Highway Commission this procedure marks a distinct advance in the technic of constructing concrete pavements or bases for other types of pavement.

A Unique Office Building



The Concrete Pressure Pipe & Construction Company of Gilroy, California, has found a new and novel use for concrete irrigation pipe. The company built its office of the pipe, and the accompanying photographs show how effective such a construction is.

Eight-inch tongue-and-groove pipe, set in an upright position three tiers high form the walls, with ten-inch pipe at the corners. The pipe in this case is three feet long, the lowest tier being set in concrete six inches below the surface of the ground, for a foundation. The concrete floor is an additional two inches in thickness. The corner and center columns are filled with concrete, and reinforced with half-inch iron pipe. Reinforcing steel set in concrete binds the walls around the top. The roof is set on a frame which is studded thickly with nails imbedded in concrete at the upper ends of the pipe. The company plans to complete the roof shortly by using split six-inch sewer pipe as roofing tile.

A curbing of concrete enclosing flower beds surrounds the building, and two Italian cypress trees set in flower pots made of halves of twelve-inch irrigation pipe are placed on each side of the door. The severity of the front, under the peak of the roof, is relieved by panels formed by an arrangement of split four-inch sewer pipe, and set vertically against the face. A wash of white cement was used on the interior.

The structure has the advantage of being simple and neat in design, decidedly appropriate as well as unique, and pleasantly cool in summer and snug in winter. As an advertisement it is an excellent investment, because of its originality and simple attractiveness. Almost without exception everyone stopping comments on the structure, and often mentions the fact that he has heard of it from others who have passed it on the highway. The firm has received a letter from Berlin, Germany, requesting photographs and a descriptive article.

One type of trade mark

Selling Methods That Created Business

Some Hints from the Experiences of a Veteran Salesman of Concrete Block

THE concrete block salesman who takes time to study the every-day habits of his industry in the territory he serves will discover things that will be of great help to him in his sales work. In this article we will follow the tactics used by a very successful block manufacturer in "getting next" to his territory. The location of this product man's market is not important. Similar conditions exist almost anywhere, and his conclusions are as applicable to your business as they were to his.

Who Buys the Block?

The first thing is to find out who buys or selects the block—the architect, the owner, the general contractor or the mason contractor? Habits will vary in different locations in this regard and will even change in a given locality from time to time.

In some locations the owner is the deciding factor. In others the general contractor buys the block and sublets the mason work. In still other locations the mason contractor buys the block and puts it into the wall. An accurate analysis of the buying habits in your sales area will provide a basis on which a fair division of sales attention could be made.

In one locality it was found that the owner used to do the buying. Later the mason contractor was the heaviest buyer, and now the shift is toward the general contractor. All of these, as well as the architect, are sales prospects, but they can be rated in importance and sales efforts adjusted accordingly.

The interests of each of these classes of prospective buyers vary and they should be appealed to from different angles. If you have studied your own block carefully you can find various points that will appeal to each of these groups individually.

The Architect

The architect is particularly interested in structural quality and possibilities for beauty. He is not generally a direct sales prospect, but his preferences often influence the decision for or against the use of concrete block in the structure he is designing. Work with the architect is more in the nature of promotion than direct sales.

The architect too often still has the impression that concrete block are made by irresponsible men in a slipshod manner. He must be sold on the fact that you are a responsible manufacturer who is making and selling a quality product that deserves his attention.

Dealings with the architect should be conducted in a dignified manner. Go to him only with a very definite message. Give him explicit facts on the quality of the product and the service you can render. Know your local building code requirements in relation to concrete block thoroughly, so you can discuss them with him.

Use a good grade of stationery when writing to the architect. An attractively designed letterhead will attract his attention and will convey the idea that you are in the business to stay. Some products manufacturers have a special hand-lettered letterhead for use in writing to architects. Circulars sent to architects should be attractively gotten up and should feature beautiful homes built with concrete block.

Most architects have certain definite office hours to see material men and it usually is not difficult to get the story of the concrete masonry unit before them. When they are sold on the desirability of this unit, are confident that your block is a quality product, and are sure that you can deliver blocks in the volume they desire, they can do much to increase sales volume.

The Owner

The owner's point of view is, in many respects, similar to the architect's. He, also, is interested in structural quality and appearance.

Enter into the owner's viewpoint when you see him. The erection of the proposed building is very probably an important event in his life. Make him feel that you appreciate this fact. It is *his* home or store or factory and it means much to him.

Tell him about the quality of your block, their strength, fire safety, durability, etc. Assure him that his wants will receive your personal attention and that only the very best block will be delivered to his job. If you know who the mason contractor is who will erect the building, speak a good word for him. It will gain the good will of the mason and will make the owner feel more confident.

The best time to see a prospective owner is in the evening at his home. Select a time, if possible, when his wife can also be present. She has much to say in the planning of the new home and in the selection of the materials to be used.

The General Contractor

The service you are able to render is an important item from the general contractor's viewpoint. He wants to be sure that materials will be delivered as specified.

An important help in maintaining deliveries is to watch your stock pile. The man in charge of the outside work ought to co-operate with the plant foreman to keep enough blocks of each shape and size in stock to meet current demands. Business, also, can be anticipated to a certain extent and provisions can be made to meet expected unusual demands. It is embarrassing to land a job and then not be able to make deliveries as quickly as desired. It is not always possible to make up the units and cure them in time for use.

Special and unusual shapes, often required on some types of jobs, can usually be made up as needed. To do this, it is well to know the principles of making good concrete so that small rush jobs can be turned out by using special methods which will give high early strengths and permit the use of the unit sooner than with the standard manufacturing methods.

A perpetual inventory of the materials in stock should be kept and checked from time to time. The stock balance can be adjusted to meet varying demands if the manufacturer knows at all times just what is carried in stock and keeps in touch with the trends in his sales area.

The general contractor is, of course, also interested in quality and appearance. Often he lays up the block himself and then the features discussed later for the mason contractor will appeal to him also.

If a general contractor builds many houses or uses a large quantity of block each year, it may be well to give him the advantage of a special commodity rate. If, for instance, he uses 15,000 block each season, a refund of one cent per block might be good business.

The general contractor usually spends a definite part of the day in his office. That is the best time to see him. He is usually too busy and too much occupied when he is out on the job to give you his undivided attention.

Be as brief as possible when you see him. Tell a definite story, then get out. If possible leave something behind, a booklet or folder, etc. Do not crowd him. Many sales are lost because too much has been said.

The Mason Contractor

The mason contractor is interested principally in getting the block laid so that they make an attractive wall at as little expense as possible.

Tell him that you have a *hard* block, the corners and edges of which will not break off in handling or delivery. Tell him that your block is square, that the surfaces are true and even, and that the dimensions are accurate and uniform. Stress the light weight of your unit and the ease of handling. These items all have a direct bearing on the cost of his work and on the quality of the job.

The mason contractor is very much interested in the service you give. Dependable deliveries are very important to him. He cannot be delayed for lack of units if he is to realize his profit.

There is a vast difference in methods of delivering block to the job. If the truck men bang up to the job and dump their load any old place, the mason contractor will not be particularly favorably impressed. It is worth while to get a good class of truck drivers. They can do much to gain the good will of the mason. It is worth while to put the block at the best place for the mason rather than the most convenient place for the truck driver. Usually it takes very little more time and it means a lot to the contractor. Sometimes it is even advisable to place the block in various piles around the job.

The truck men should take an interest in the jobs they deliver to. It is time well spent for them to talk the job over with the mason contractor, discuss deliveries and places to unload, etc. They can easily manifest their desire (and their employer's) to co-operate with the mason. Truck drivers doing this have often been able to dig up a lot of new prospects for the salesmen. Often they can be trained to watch the job so closely that it will be unnecessary for the salesman or the products manufacturer to visit the job.

The mason contractor usually has his office in his home. Generally it is possible to see him on the job, but it is desirable to see him at his home if your call will require considerable time. Many times business can be transacted over the phone in the evening. When this is done, the best time to call is after he has had his dinner and before 8:30 P. M.

Other Sales Helps

It is desirable for a products manufacturer to adopt some trade mark or brand for his products. This usually costs very little and brings definite returns.

In selecting the trade mark, choose something that conveys a message and that emphasizes some particular qualities of your block. For instance, one block manufacturer uses a three-cornered star and ties this up with his "three points of superiority—strength, light weight and color." If possible, tie up some word with your brand, such as "dependable"—not just block, but "dependable block."

Carry this trade mark on all your literature, on your letterhead, price lists, bills, etc. Get it thoroughly identified with your product. It is not expensive to brand your concrete block with the trade mark. It can be stenciled on the block in the stock pile quickly and easily. The yard men can do this in their spare time.

When loading trucks, place the block in such manner that the brand is visible from the sidewalk. Then pile the block on the job in such a way that the brand is easily seen. The block in the stock pile at the plant can also show the brand to the passer-by.

A job sign with the trade mark prominently displayed is also a good investment. It is good policy to use the mason's name on the sign, too, such as "Bing's Dependable Concrete Block used on this job by John Doe, Mason Contractor."

Advertising

Nothing takes the place of personal contact as a means of advertising your product, but unfortunately there are usually so many prospects and possible prospects that it is impossible to maintain continuous contact with them by means of personal visits. It is necessary to enlarge the scope of your contacts and this can be done by writing letters. Letters must be good, or it is a waste of money to send them.

One products manufacturer sends out a cardboard "newspaper" every month to his mailing list. It is printed on both sides and need not be opened. As it comes to the prospect's desk, it is an invitation to read it. The contents of the "newspaper" vary. Local news affecting the concrete block industry is featured and jokes are liberally sandwiched in. Only occasionally is there reference to this particular manufacturer's block. The value of the mailing is that each month the name of the manufacturer is placed before the prospect in a pleasant, interesting manner. Contractors and architects have learned to look forward to seeing the next issue of the "newspaper."

When planning your letters or other direct mail advertising, sit down and analyze your product from the buyer's point of view. Get the features of superiority over other block and then present your arguments intelligently and consistently. Have a definite message in each mailing and make it as interesting as possible.

In the smaller communities newspaper advertising will bring results. But it must be real advertising, not merely an "ad" or a business card. The same story used in your direct mail advertising, boiled down and condensed, will prove effective.

In the larger communities, co-operative advertising, selling the concrete masonry unit in general, has been found to yield good results. Such advertising should be of an educational nature—it could tell how concrete block are made, describe the results of fire tests, show how block are used in various types of structures, etc., etc.

These are some of the practical suggestions resulting from long experience in making and selling concrete block. They are presented as the findings of one products man. Many of the suggestions will fit into your territory. Perhaps you have found certain sales methods more effective than others. Your experiences, also, will be of value to other products manufacturers.

Light-Weight Aggregate

Use of Light-Weight Aggregate Is Important Development in Concrete Field—Development of Use—Types of Light-Weight Aggregates Available—Their Advantages —Tests—Methods of Preparation and Use

ONE of the most important recent developments in the concrete construction field is the increasing use of light-weight aggregates. Because of their lower weight, lower sound conductivity and better insulating qualities, concrete made with this type of aggregate is steadily gaining in favor.

The advantages of light-weight aggregates are equally important in the structural and concrete masonry units field, though up to the present time, they have been used principally in the manufacture of concrete block and tile. Normal concrete weighs about 150 pounds per cubic foot, while light-weight concrete of equal strength weighs only from 90 to 100 pounds per cubic foot. The advantages of the use of this type of aggregate are readily seen. They include:

(1) Less labor in handling and placing.

(2) Improved fireproofing qualities.

(3) Lower sound conductivity.

(4) A saving in reinforcing steel because of the lower dead load.

(5) Reduction of cracking because of greater flexibility of the aggregate.

(6) Nailability.

Types of Light-Weight Aggregates

Several types of light-weight aggregates are available and are now being used, principally in the manufacture of concrete products. The preparation and use of all these materials are covered by patents and they are used under licenses which are granted to manufacturers for definite territories.

Until very recently, the use of porous, or light-weight aggregate has been limited almost entirely to cinders, though experiments made about 1918 with burned shale aggregates in an effort to make concrete ships, also helped to bring the possibilities of light-weight aggregates before engineers.

Probably the greatest progress made with light-weight aggregates has been in the production of cinder concrete block. Though the manufacture of these units did not begin until about 1918, estimates of the 1927 production of cinder concrete block reach the astounding total of between 75,000,000 and 100,000,000 units.

The use of cinders for making concrete block is covered by patents held by the National Building Units Corporation, 1600 Arch Street, Philadelphia, and by Cordery Cinder Products, Inc., Passaic, N. J.

Other light-weight aggregates are produced by burning or blast-roasting clay or shale. An aggregate of this type is known as Haydite, made under patents held by the Haydite Company, Mutual Building, Kansas City, Mo. This material is now being produced in several plants in various locations and is being used by more than one hundred concrete products manufacturers. It has also been used in reinforced concrete for building several important structures in the middle west.

Haydite is clay or shale that has been burned in large rotary kilns to the fusing temperature. During the burning, certain gases are released and it is this feature that gives Haydite its cellular structure. The resulting clinker is then ground, crushed and screened to reduce and separate it to the sizes required.

Haydite weighs from 1400 to 1700 pounds per cubic yard, depending upon the size of the material. The finished concrete will average from 30 to 35 per cent lighter and tests have shown it to be equal or greater in strength than concrete in which other aggregates were used.

A new method of manufacturing a light-weight, vitrified clay aggregate has been developed and patented by F. A. Glass, 729 Hearst Building, Chicago. This aggregate is called "Sinter" and is made by applying to the production of aggregates the principle of blast-roasting or sintering, a well-known metallurgical process used in the mining industry for converting finely divided metallic ores into a lump form. Sintering has been applied to clay materials of a wide range of physical and chemical composition with success.

In general, fine aggregates of clay sinter weigh about 50 pounds per cubic foot and coarse aggregates about 35 pounds per cubic foot,

Use of Light-Weight Aggregates

The use of aggregates of these types is well suited for manufacturing concrete block, tile and other load-bearing and partition building units. Nails may be freely driven into the concrete as the enclosed cells of the aggregates provide space for the nails without rupturing the concrete.

Concrete of this nature does not take a mirror-like polish due to the multiplicity of cells that are cut through, but it does show a smooth, soft, pleasing texture.

To obtain the best results with light-weight aggregates, greater care must be exercised than when sand and gravel are used. Sloppy concrete leads to segregation of the aggregate upon which they float—just the reverse of the behavior of heavy aggregates. To obtain a low water-cement ratio consistent with workability, it is worth while to premix the cement with water and then add the fine and coarse aggregates. They should be mixed for at least one minute.

A. C. I. to Meet Next in Philadelphia

Philadelphia, Pennsylvania, has been chosen as the place of convention for the 1928 meeting of the American Concrete Institute. The Benjamin Franklin Hotel is the place and February 28, 29 and March 1 the date.

Of 404 ballots sent to Institute members, 120 indicated Chicago as their choice, with Philadelphia, New York, New Orleans, Detroit, Cleveland, St. Louis, Atlantic City, Kansas City, and Pittsburg following in the order named. However, divided into zones, there were a predominance of votes for locations within 250 miles of Philadelphia. Another point in favor of the eastern city is the fact that membership in the Institute is very much more congested within 250 miles of Philadelphia than within 250 miles of Chicago.

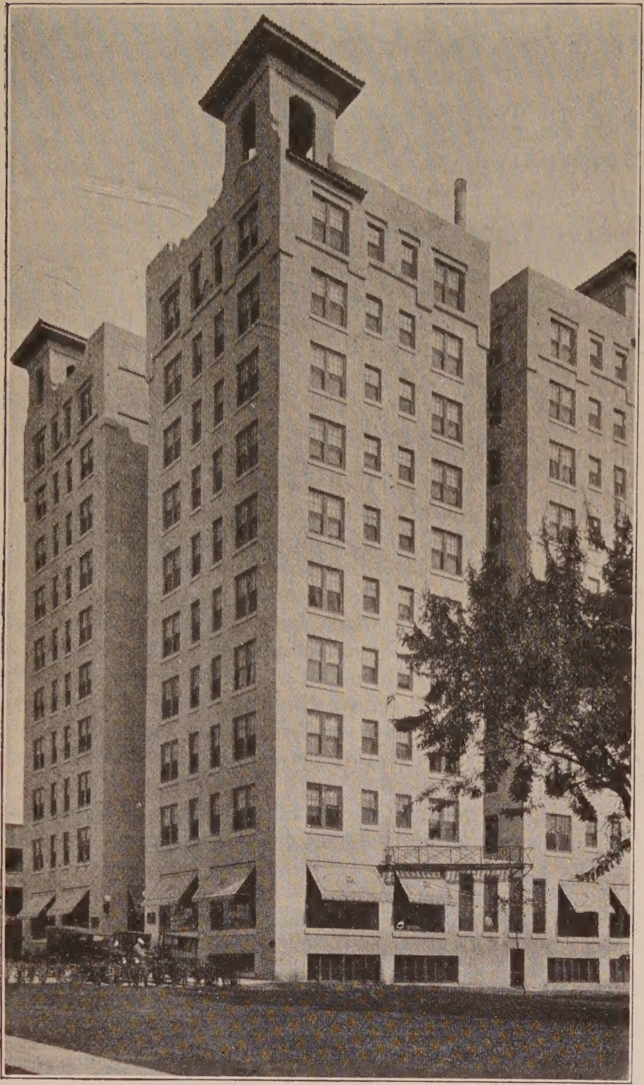
Tall Concrete Buildings in Miami

TWELVE reinforced concrete buildings ranging in height from ten to fifteen stories constitute an impressive group of structures in the down-town sections of Miami and Miami Beach, Florida. In this respect Miami is well up toward the lead in number of tall concrete buildings, when the population of the city, estimated roughly at 150,000, is taken into consideration.

None of the tall concrete buildings in Miami presented any special construction difficulties comparable to the problems involved in two buildings in Dayton, Ohio, described and illustrated on page 20 and 21 of the March (1927) issue of CONCRETE. In the Miami structures the floors and the structural skeleton of columns, piers and girders are of a standard reinforced concrete design; but for the most part the exterior filler walls consist of hollow clay tile coated with portland cement stucco.

Cement Stucco Finish

In the matter of exterior finish, eleven of the twelve tall concrete buildings in Miami and Miami Beach are coated with cement stucco. From the standpoint of appearance there are great possibilities in the use of stucco exteriors for large buildings of the hotel and office building class. This is quite evident from our illustrations. Furthermore, there is no question that the stucco exterior is considerably more economical than the various kinds of



Henrietta Towers Apartment Hotel, 10 stories high

Venetian Hotel, 10 stories high

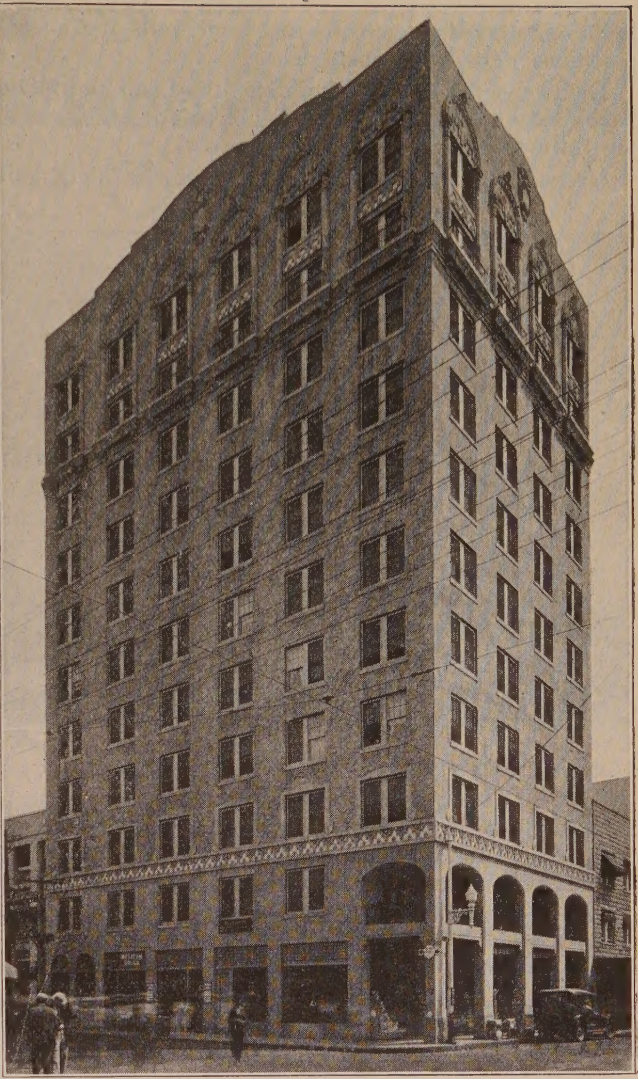
Dallas Park Apartment Hotel, 11 stories high

Notable Feature Is Use of Cement Stucco for Exterior Finish

masonry veneer exteriors employed so extensively in the eastern and mid-western sections of this country.

The use of cement stucco exteriors on large buildings in Miami is similar to the practice in Los Angeles, with the important structural difference that in the California city the exterior filler walls in many tall buildings are of reinforced concrete cast monolithic with the structural frame. The practice in Miami of building tile filler walls, coated with stucco, may result in a slight advantage in first cost; but the greater rigidity obtained with the reinforced concrete filler wall cast integrally with the structural frame is an advantage that should not be overlooked. This is of particular importance in areas subjected to occasional earthquake shock, tornados or hurricanes, where the structural resistance of a building may be tested to the utmost.

Nevertheless, the great rigidity of the reinforced concrete structural frame, even when unassisted by monolithic concrete filler walls, was demonstrated in a spectacular manner in the great hurricane that held Miami at its mercy for twelve hours on September 18, 1926. The twelve tall concrete structures, though exposed for nearly or all of their full height, suffered neither structural damage nor damage to non-structural parts, as filler walls and interior partitions. In contrast to this performance, one tall steel building was distorted and damaged to the extent that its demolition followed, while two other steel



Cortez Hotel, 11 stories high

The Miami Bank & Trust Co. Building, 11 stories high

The Flamingo Hotel, Miami Beach, 11 stories high buildings swayed so violently that filler walls and interior partitions were badly shattered.

The twelve tall concrete buildings in Miami and Miami Beach that established this enviable record are listed in the following condensed descriptions:

Fleetwood Hotel, Miami Beach, 15 stories high, built in 1924, by the George W. Langford Co. Frank V. Newell, architect, Miami; Robert S. Fiske, structural engineer, Atlanta, Ga. Exterior finished in cement stucco.

Fleetwood Hotel, Miami Beach, 15 stories high

Floridian Hotel, Miami Beach, 12 stories high. Exterior finished in cement stucco.

Alcazar Hotel, North Bay Shore Drive, Miami, 13 stories high, built in 1925. Exterior finished in cement stucco.

Floridian Hotel, Miami Beach, 12 stories high

El Commodoro Hotel, Miami, 12 stories high, built in 1924 by R. B. McCalley, general contractor, Miami. George Fink, architect, Miami. Exterior finished in cement stucco.

Miami Bank and Trust Co. Bldg., 127 Southeast First St., Miami, 11 stories high. Built in 1925 by the George W. Langford Construction Co. Hampton & Ehmann, architects, Miami. Exterior of brick veneer.

McAllister Hotel, Bay Shore Drive and Flagler St., Miami, 11 stories high. Exterior of cement stucco.

Cortez Hotel, First Ave. and Third St., N. E., Miami, 11 stories high. Built in 1924 by Fred T. Ley & Co., general contractors. Edward A. Nolan, architect, Miami. Exterior is of cement stucco.

Flamingo Hotel, Miami Beach, 11 stories high. Exterior finished in cement stucco.

Venetian Hotel, North Bay Shore Drive, Miami, 11 stories high. Built in 1925 by the Turner Construction Co. Architects, Pringle & Smith, Atlanta, Ga. Exterior is of cement stucco.

Robert Clay Hotel, Miami, 11 stories high. Exterior finished in cement stucco.

Dallas Park Apartment Hotel, Third St. and First Ave. S. E., Miami, 11 stories high. Built in 1924-1925 by the George W. Langford Construction Co. Architects, Robertson & Patterson, Miami. Exterior of cement stucco.

Henrietta Towers Apartments, 347 S. E. First Place, Miami, 10 stories high. Built in 1923-24 by A. J. Scherer, owner. Architect, R. A. Preas, Miami. Exterior is of cement stucco.

First Half of 1927 Shows Advance in Building

The greatest volume of construction ever undertaken during the first six months of any year on record has been registered since the opening days of 1927, according to statistics compiled by the Associated General Contractors of America. Continuance of operations on a vigorous scale last month placed the total for the six-month period of this year four per cent above the figure established during the corresponding period of 1926 which held the previous record.

Strong indications that the present record-breaking pace will be maintained are found in the enormous amount of contracts for future construction work that recently have been awarded. The volume of awards made in May was greater than any recorded for that month in any previous year. The total of awards for the first five months of 1927 exceeds by five per cent the figure recorded for the corresponding period in 1926.

A scale which places the 1913 average at 100 as its basis shows the June volume of construction to have reached the 212 level. Index figures for the first five months of this year are: 129; 121; 135; 166; 197. Corresponding figures for the same month of 1926 are: 137; 117; 119; 151; 179.

The index figure for volume of contracts awarded during May is 233. The May, 1926, mark was 227.

Road Builders Establish Hotel Bureau

The American Road Builders Association Hotel Committee has established a bureau, to open September 20th, for the purpose of making room assignments for the 1928 convention. A list of Cleveland, Ohio, hotels has been compiled from which those planning to attend may take their choice. Requests should be addressed to Mr. A. J. Kennedy, Vice Chairman, Hotel Committee, 304 Chamber of Commerce Building, Cleveland, Ohio.

Relation Between the
Characteristics of Portland Cement *and* Deterioration of Concrete

A Discussion of Some of the Characteristics of Portland Cement and Concrete for the Purpose of Arriving at a Clearer Understanding of Why Some Concrete Remains Good and Why Some Disintegrates—Some Suggestions for Improving the Durability of Concrete

By JOHN R. BAYLIS
Filtration Engineer, Bureau of Engineering, City of Chicago, Ill.

Part II—Compounds in Solution During the Setting of Cement

Part I of this analysis was published in the July issue. It discussed the Characteristics of Portland Cement as a background to the principal problem which the author presents—that is, an attempt to determine why some concrete remains good while some disintegrates.

Part II continues the discussion with a study of what actually happens when cement "sets." This will be followed by further analyses of the effects of certain chemicals formed by the hydration of the cement on the concrete and will conclude with some constructive suggestions for increasing the durability of cement.

It is the purpose of these articles to encourage the better handling of a product that is already good.

THIS is not intended to cover all chemical changes taking place as a result of the addition of water to cement, but only such changes as may influence the compounds produced, or, where a knowledge of their characteristics seems essential for a clearer understanding of why deterioration can take place.

It is not possible to obtain sufficient solution for testing when water is added in the proportions used in practice and it is necessary to use a slight excess of water. Test conditions, however, should not deviate greatly from actual practice.

Considerable time has been given to working out a method of procedure for testing that will give results comparable to working conditions. To prevent the cement from lumping there must be some means of agitation and the sample must be protected from the air. Not only this, but a procedure must be adopted that does not require too much labor, for many tests have to be made. Taking everything into consideration, it is believed that the procedure used is about as near to that of actual conditions as is practical to obtain.

Method of Testing

Two-hundred gram samples of cement were mixed with 225 cc. of distilled water, or with water having a definite quantity of some compound. The mixture is then agitated continuously or at certain intervals of time to prevent lumping. From this it is usually possible to get from 100 to 125 cc. of clear solution after filtration. The amount of water is considerably more than is used in practice, and there may be some deviations in the soluble compounds from actual conditions, but it is believed that this is near enough for reliable information.

For many of the tests the mixture was agitated in a rotating grinding and agitating machine. A steel ball about ¾-inch in diameter prevented lumping, and did not seem to grind the cement particles much finer than they already were. The agitation is different from working conditions, except for the few minutes when the concrete is being mixed and placed, but it is essential to keep the cement and water mixed continuously throughout the test. By packing the flask in the machine with some good insulating material and inserting a thermometer through the stopper, temperature variations due to the reactions taking place can be determined. However, this is not the most accurate method of studying temperature changes. One interesting thing in connection with the increase in temperature is that it does not increase very much until after nearly all the SO_3 has gone into chemical combination with the cement compounds. This will be discussed more fully in another paragraph.

First Reaction of the Water with the Cement

When water is added to portland cement there is rapid union of the water with the cement compounds in the outer surface of the cement particles. Even though the particles are extremely small, there is still the distance of many molecules in thickness from the surface to the center of the particles. If particles 0.001 mm. in diameter were magnified to one foot, the individual molecules probably would still be invisible.

The wetting of all surfaces of the particles brings only a very small percentage of the total molecules in contact with the water at first. The surface molecules go into solution very quickly, which in turn exposes other molecules. This continues, perhaps at a diminishing rate, as the water nears the saturation point of certain compounds.

After a certain supersaturation is reached, which may require from 1 to 10 minutes, precipitation of the hydrated products begins, though perhaps not at a very rapid rate until there is considerable supersaturation of some of the compounds. The precipitated products slow up the rate of reaction by partially excluding the water from the inner molecules.

The saturation point of the high calcium silicates and aluminates in a solution saturated with calcium hydroxide is very low, perhaps only a few parts per million or even less. Filtering and testing the solution within a few minutes or a few hours after the water is added, will show very little soluble silica and alumina. It is calcium hydroxide, calcium sulfate, and the compounds of sodium and potassium that are usually found in considerable quantities shortly after water is added to portland cement.

Alkali Concentration of the Water During the Setting of Cement

The curves in Figure 1 show the alkalinity and SO_3 which are in solution in the early stages of the setting of the cement. It will be noted that the soluble alkali, which at first is largely calcium hydroxide, increases to a point above the saturation point of calcium hydroxide within a few minutes. There is hardly any doubt about a supersaturation being produced, for the reduction in the amount of acid necessary to neutralize the solution is decreased after 1 to 3 hours for most of the cements tested, indicating a precipitation of some of the calcium hydroxide.

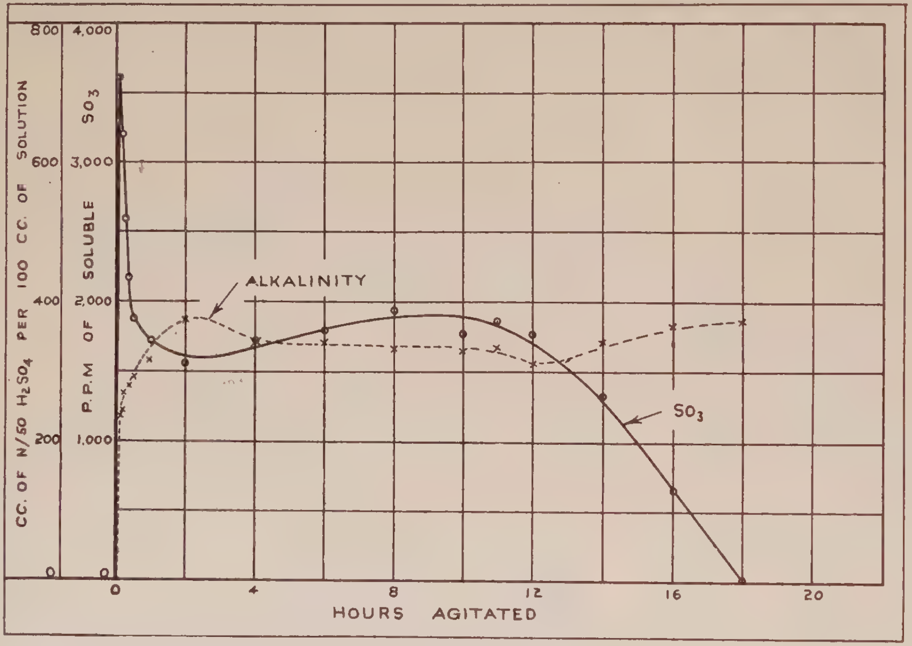


Figure 1

The writer can conceive of no reaction that would reduce the calcium hydroxide in solution at this stage of the hydration other than for it to precipitate as calcium hydroxide. The excess over the saturation point cannot be there as an aluminate or silicate, for neither of these compounds are in solution in quantities sufficiently great to account for the drop in alkalinity.

The sodium and potassium going into solution very likely unite with the SO_3 so long as it is present in considerable quantities, but all the SO_3 soon unites with the high calcium aluminate as it hydrates. The sodium and potassium are then converted back to the hydroxide, and if present in considerable quantities, this causes a material increase in the alkalinity of the solution. In one instance the increase was about 40 per cent, even though some of the calcium hydroxide was precipitated out as the sodium and potassium hydroxides increased.

The alkali concentration of the solution within the pores of the cement continues to increase for a long time as the cement particles gradually undergo hydration. The sodium and potassium in solution are approximately doubled within 5 days over what they were at the time the SO_3 disappeared from the solution. Longer tests have not been run, but it will likely continue to increase until all the cement has hydrated. Should the sodium and potassium be uniformly distributed throughout the cement particles it is possible that the percentage in solution of the total amount that finally goes into solution is a measure of the cement that has hydrated.

There are other factors, such as diffusion from the interior of the cement particles to the outside, that will probably prevent the test from being an accurate measure of hydration rates.

The first thing that happens when the sodium and potassium hydroxides begin to increase in the solution is to force the calcium hydroxide out of solution. Fully one-half of the cement in some of the concrete that is now being manufactured hydrates in a solution in which the sodium and potassium are so high that less than 25 per cent of the normal concentration of calcium hydroxide is present.

Take the case of a cement that has one per cent of its weight before hydration as sodium and potassium oxides, and assume that these compounds are uniformly distributed throughout the particles. After the hydration has extended into the particle to the point where the precipitate of hydrated cement on the outside of the particles materially retards diffusion rates from the interior of the particles, then it seems possible for the water within the hydrated portion of the precipitate on the particles to contain a concentration of several per cent of sodium and potassium hydroxides.

If this high concentration reduces the calcium hydroxide concentration to nearly the zero point, how is this going to affect the hydrated cement compounds being precipitated? Fortunately much of the sodium and potassium in most raw materials is driven off by the burning, and probably in most instances where it is high in the cement, it is due to reclaiming the flue-dust, which is where a large part of these compounds are precipitated. In this case the amount in the cement may be high but there is not so much uniformly distributed throughout most of the cement particles. All of this may not have much influence on the quality of concrete produced, but the sodium compounds bring about such widely variable conditions under which the cement compounds are hydrating that it is certainly worthy of careful consideration.

Soluble SO_3

With one exception, all cements tested showed a supersaturation of the calcium sulfate ($CaSO_4$, $2H_2O$) within 5 minutes after the water was added. In some instances it was nearly 100 per cent. This is due to part of the calcium sulfate existing in the calcined or partially calcined state—possibly caused from the heat generated in grinding, though it is probable that the cement compounds have the power to take away a little of the water of crystallization. Within 1 to 2 hours the soluble SO_3 is reduced to a point where it remains nearly constant for an interval of time. This is due to the crystals of $CaSO_4$, $2H_2O$ going into solution at approximately the rate the SO_3 is combining with the hydrated high calcium aluminates, the formation of which has been materially reduced from the rate at which they were being formed shortly after the water was added.

Most of the brands of cement tested showed a slight increase in the soluble SO_3 from the minimum point near the 2-hour period to where it starts on its final drop. This is shown by the curve in Figure 1. The cause for the increase must be due to sodium and potassium going into solution and combining with the SO_3. The point where the SO_3 concentration starts on its final drop after several hours is where nearly all the $CaSO_4$, $2H_2O$ crystals have gone into solution.

Two Periods of Fairly Rapid Chemical Reactions in the Setting of Portland Cement

There appear to be two periods of fairly rapid chemical reactions in the setting of cement. The first is immediately after the water is added, and it usually has slowed up quite materially within 15 to 20 minutes, which is before the initial set takes place. The second is after nearly all the SO_3 has gone into chemical combination with the cement compounds. The latter presumably is about the time of, or after, the cement takes its permanent set.

The first period of rapid chemical reaction is the union of the water with the outer molecules of the cement particles, and the calcium sulfate going into solution. The solution quickly becomes saturated with calcium hydroxide and calcium sulfate, also certain of the cement compounds. The cement compounds, however, exist in solution in such small quantities that there is rapid precipitation and the formation of a film over the cement particles that materially slows up the rate of reaction. Presumably the SO_3 is very effective in precipitating this thin and adherent film that prevents the water from gaining rapid access to that part of the cement which has not hydrated. So long as SO_3 remains in solution in considerable quantities, that is, to nearly the saturation point of calcium sulfate, rapid chemical reaction seems to be prevented.

After nearly all the SO_3 has gone into chemical combination with the high calcium aluminates there appears to be another period of increased chemical reaction. The main proof we have of this is the heating of the cement. From the heat generated, this appears to be a period of much more rapid reaction than the first one except for the first 10 minutes. In fact only 3 to 5 degrees C. is all the heat generated within the first 15 minutes with the particular cement tested. This is shown by one of the curves in Figure 2.

April 15. 1927 J.R.B.

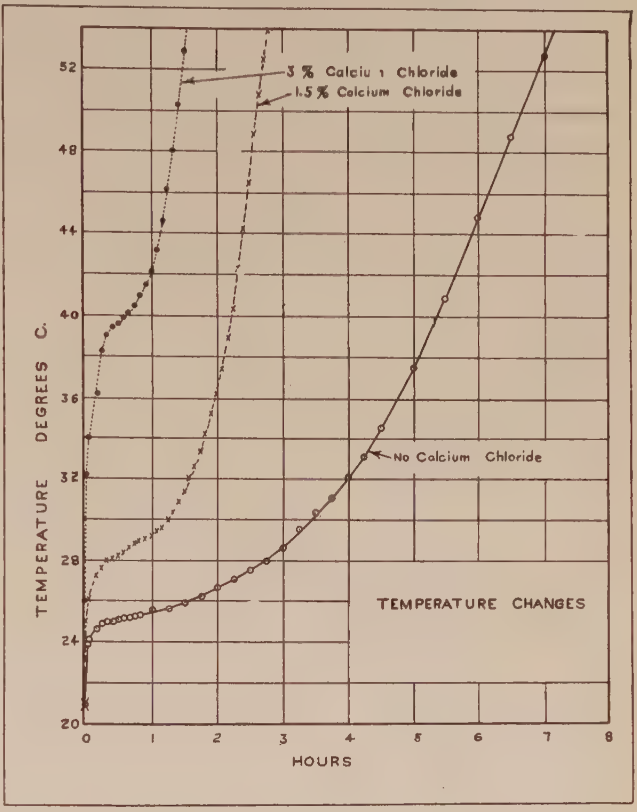


Figure 2

The device used for testing the rise in temperature should give accurate results, for the surrounding temperature was kept within one-half degree of the temperature of the cement. The fact that the temperature increases only slightly over a period of nearly one hour is interesting and makes one wonder if there are reactions taking place in cement tending to reduce the temperature as other reactions are giving off heat. We must assume this or assume that there is nearly complete stoppage of the chemical reactions, which does not seem possible. The temperature curves for calcium chloride in Figure 2 show that chemical reactions are hastened by the addition of this compound, yet these curves show a period of about 30 minutes in which the rate of reaction is slowed up materially.

The temperature begins to increase much sooner for the tests shown in Figure 2 than in Figure 3. This may be due partially to the fact that only 40 per cent of water was used for the temperature tests whereas 112.5 per cent was used for the soluble SO_3 tests, but it is more likely that the agitation had the greatest influence, for this kept the SO_3 uniformly distributed in the water.

A large number of tests on seven different brands of cement did not show any material heating of the samples until the concentration of SO_3 was considerably less than 1,000 parts per million, even though it required 12 to 16 hours for it to be reduced to this amount in some of the samples. This seems to indicate conclusively that there is some relation between the SO_3 in solution and the retarding of the chemical reaction. It also indicates that the film formed first undergoes a change in structure within a fairly short time, perhaps 20 to 30 minutes, which allows the water to gain access to the portion of the particles which have not hydrated, unless there is additional SO_3 present in solution to keep forming the film as the cement gradually hydrates.

With the calcium sulfate present as crystals scattered throughout the mass, the diffusion of soluble sulfates from the crystals to all portions of the cement may be so slow that increased reactions are allowed to take place at numerous points throughout the cement before all the SO_3 has gone into chemical combination with the high calcium aluminates.

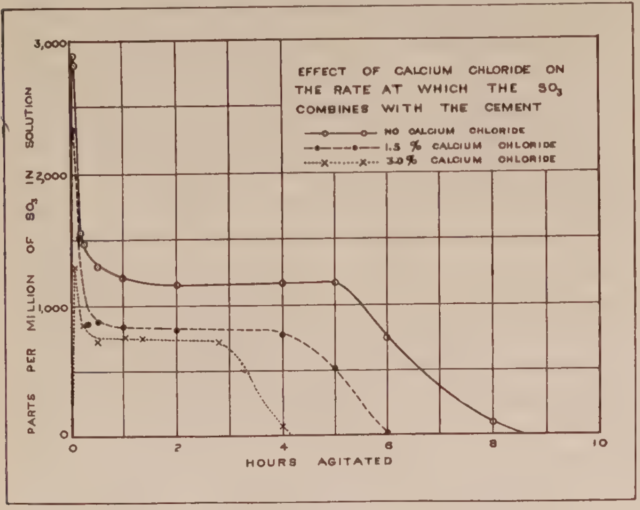


Figure 3

The Retarding Film

What is the nature of this adhering film and what causes it to change? It is known that some chemical reactions which take place rapidly produce a gelatinous precipitate at first which later changes over to a more crystalline state. This is particularly noticeable in the rapid production of a gelatinous calcium carbonate precipitate.

It is likely that there is some such reaction between the SO_3 and the calcium aluminates as they undergo hydration. The writer has given some consideration to the proof of this assumption, and while aluminum precipitates have been produced that appeared to undergo such a change by shrinking materially in volume, positive proof of this is still lacking.

Whatever be the nature of the precipitate produced, it forms a film on the cement particles too thin to be detected. It is probably much less than 0.001 mm. in thickness. It is also evident that the film is not permanent, or it would keep the reaction slowed up indefinitely. The use of large amounts of calcium sulfate in cement does not prevent it from eventually hardening, even though the strength may never be very great. The SO_3 is not something that completely stops the hydration of the cement compounds, for the SO_3 would also stop going into chemical combination, but it slows up the rate quite materially. If the SO_3 would only form some kind of a compound in cement during the process of setting that later would not undergo a change due to CO_2 gaining access to the concrete, the amount added to control the set would be of no consequence, but it does not do this. Another article will deal more fully with the part sulfates play in the deterioration of concrete.

The Effect of Calcium Chloride

This is not intended to be more than the statement of a few experimental facts covering certain phases of the effect of chlorides. Calcium chloride is given by some writers as being suitable for retarding the initial set of cement, though its use now is chiefly to hasten the set of cement which already has calcium sulfate added.

The curves for increase in temperature in Figure 2 and for soluble SO_3 in Figure 3 show that chlorides hasten the reaction of the cement with the sulfates. How this is done is not known to the writer, but there is the possibility that it hastens the conversion of the gelatinous precipitate to a more crystalline one, if the assumption of a gelatinous film is correct. The nature of the curve indicates this slightly, but by being nearly flat for a certain period of time, it might be that it produces a less impervious film originally.

The chlorides also go into chemical combination with the high calcium aluminates to a certain extent. This is shown in Table II.

TABLE II

Reduction of the Concentration of Chlorides by Portland Cement

Time Standing	Parts per Million of Cl in Solution
Water added	8,050
7 hours	5,800
24 hours	3,150
48 hours	2,200
3 days	1,750
5 days	1,550

Two hundred and twenty-five cc. of solution containing the chlorides as calcium chloride were added to 200 grams of cement and the mixture stoppered tightly. It was agitated frequently to prevent hardening.

It is known that chloraluminates are formed under some conditions when chlorides are in the presence of aluminum and calcium hydroxide, and it is possible that such a compound is formed. It is also possible that the chloride ions are adsorbed by the hydrated high calcium aluminates. In fact, the extraction of the chlorides from hydrated cement gives very good proof that they are held by adsorption rather than definite compounds, for there is no point indicating the breaking down of a definite compound.

Hydrated Calcium Aluminates May Be Troublesome Compounds

If neutral salts such as calcium sulfate come in contact with hydrated calcium silicates of the form occurring in concrete, they do not appear to have any appreciable effect, but this is not the case with the high calcium aluminates. Most of the alumina, if not all in cement, is in a form that will unite with certain negative ions, such as the sulfate ions, should it come in contact with them at any time throughout the life of the concrete. This is assuming the alumina to be present as the high calcium aluminates as originally formed when the cement sets.

The very compound used to retard the rapid initial hydration or set of cement will continue to unite with the aluminum compounds to the extent of disintegrating the concrete if there is any way an additional amount can get to the concrete. This also applies to the chlorides, but their disintegrating tendencies do not appear to be so great as those of the sulfates.

It will be shown that the tendency for sulfates to continue to unite with the cement compounds containing high calcium aluminates is one of the most serious problems

Continued on Page 41

EDITORIALS

Placing Concrete

A PROMINENT engineer and contractor who has built many important concrete structures, recently said that very little originality and ingenuity is being displayed by most contractors in determining the methods they use for handling the concrete from the mixer into the forms.

The criticism seems to be well taken. Even though each job presents its own problem in plant layout and selection of equipment, the contractor usually adopts standardized methods for placing the concrete. Often he does not even consider the possibility of developing a better or cheaper method.

Recent years have brought important improvements in the art of making concrete. Theory has preceded practice and practice has not yet completely caught up. We know how to make better concrete than can be made on the ordinary job.

To the equipment manufacturer and the contractor has fallen the task of developing equipment and methods that will more nearly permit the attainment of ideal conditions for mixing and placing concrete. The contractor finds it difficult under present conditions to make and place concrete that approximates the theoretical goal. He finds that it requires an undue amount of labor, using his present tools.

Concrete engineers have done much to overcome this by studying the factors that promote workability and by simplifying methods of applying the principles for making good concrete to field conditions.

Selecting Types of Construction

"THE trouble with these concrete men is that they will recommend the use of concrete for everything, regardless of local conditions, economy or fitness." That was the verdict of an architect who made very liberal use of concrete in his larger structures as well as in his residence work. He added that those who favored concrete were so enthusiastic about it that he could not trust their judgment. He was afraid that their enthusiasm was more responsible for their recommendations than their knowledge of conditions.

Architects and builders are constantly flooded with propaganda for all sorts of materials. It is not surprising that they should look at all the claims that are presented to them critically, even skeptically.

It is well for concretors to realize that there are some conditions where another building material can be used more economically and perhaps more appropriately than concrete. If the use of other materials for conditions of this kind is admitted and concrete is recommended only for those purposes for which it is best suited, architects and builders will learn to rely on the recommendations of concretors and they will look with more favor on the possibilities for extending its uses in their structures.

Light-Weight Aggregate

IT is human nature—especially for engineers—to be conservative. They are inclined to resist new ideas until a formidable array of proof of their soundness has been established. Caution in adopting new methods of construction is commendable. But it can be carried to extremes. Progress in any industry is dependent on the degree to which that industry accepts improvements in the methods and materials with which it works.

It was long thought to be of fundamental importance that aggregates be very resistant to abrasion. The French coefficient was long the gauge by which the desirability of aggregates for use in concrete was measured. Engineers would double the cost of their aggregates to secure materials that met the standards then accepted, even though structurally sound material was easily available. Then it was learned that, provided an aggregate was structurally sound and clean, it would produce concrete of adequate strength and resistance to wear regardless of whether the French coefficient was high or low.

Another development of a similar nature now asks for acceptance. Light-weight aggregates are not an entirely new development. Many examples of their use are available for study. Pumice concrete, slag concrete, cinder concrete and burned clay aggregate concrete have been known and studied for some time. Enough data are at hand to gauge their value. But up to the present, they have been used principally for special purposes and by a limited number of engineers.

It is only recently that light-weight aggregates of the burned clay variety have been commercially produced and marketed. Their obvious advantages have brought about their ready acceptance in some fields. They are now being used in quantity in concrete block manufacture and to a very limited extent in structural concrete.

There are possibilities for even greater use of light-weight aggregates. The weight reduction they make possible reduces the sizes of supporting beams, columns and foundations. These are real advantages. They minimize another of the stock objections to concrete, namely, the size of reinforced concrete members and their large dead load. Their use opens up new possibilities for the concretor and they deserve his serious consideration.

Concrete Housing in England

The Winget Method of Concrete House Construction, as Used in Several British Housing Developments

THERE has recently been a revival of activity among British municipalities anxious to push their housing schemes forward. In Hull, for instance, where concrete is playing a large part in overcoming the shortage of bricks, new houses are springing up so rapidly that it is difficult to keep pace with their progress.

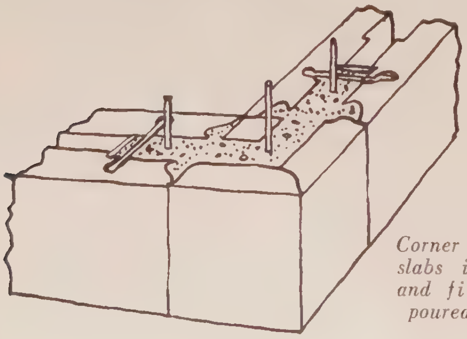
One of the methods used is what is now widely known as the "Winget" pier and panel system—a system designed to help in the solution both of the housing and the unemployed problem. This was first tried at Wakefield, where a second additional contract (for 500 of these houses) has just been awarded. On the East Hull site 400 houses of the same type have also been decided on.

A Winget double family house

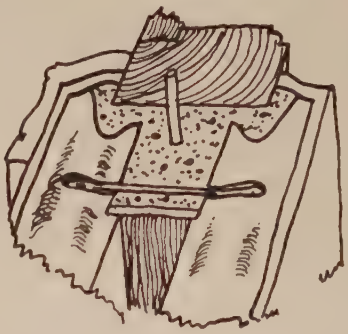
Wakefield and Hull Developments

The houses both at Wakefield and Hull have now been standing long enough to settle down into something like permanent order and appearance, with trim gardens and window curtains which show clearly enough that the tenants take a proper pride in their new homes. Monotony of color on the outside walls is avoided by a judicious variety of finishes in the way of different colored stucco, or roughcast. Idealists may bemoan the similarity of design in so many of these post-war housing schemes which are being dotted about the country, but it is only necessary to run into the sordid streets of the workers of such cities as Hull and Wakefield, and compare them with these new garden villages springing up so rapidly on their outskirts, to understand why the workers and their wives are clamoring for keys to give them possession of the present type.

The estate, itself, is admirably laid out with broad main roads and avenues of trees which time will transform into boulevards of which any town might be proud. There is nothing elaborate or pretentious in the design, and there is inevitably a certain similarity in appearance, but they are pleasantly distributed in pairs with a generous allowance of garden to each, and their simple, unaffected lines give a very welcome air of strength and comeliness.



Corner block and slabs in position and filled with poured concrete



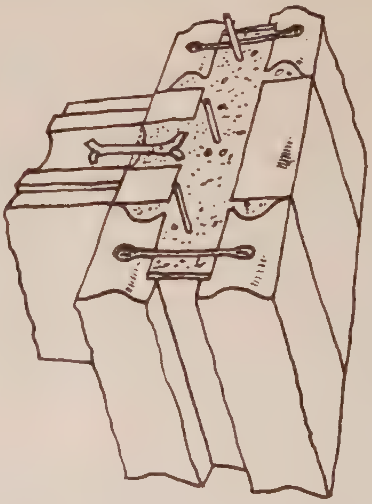
Door frame set in grooves in ends of slabs, with poured concrete in back. Window frames are constructed in the same way

No Cracks in Walls

It is difficult to find a crack in any of the walls. The rigidity of these houses is accounted for by the fact that, in effect, the buildings practically consist of reinforced frames with panel fillings, so that all tendencies toward unequal settlement are taken up by the tensional members, and distributed evenly throughout.

Construction Method

The method of construction is simple. Builders cannot go far wrong with the walling once the trained masons have laid the corner blocks plumb. Thereafter it is just a question of laying and nailing the slabs, which themselves form the shuttering for the vertical piers, and then filling with plastic concrete the pier space thus created as each course is laid. Sometimes this plastic concrete is placed after two or three courses have been laid, whichever is most convenient. All the blocks and slabs, it should be added, are made on the site.



Method of joining partition to main outside wall with "T" blocks

The A. B. C.'s of Good Concrete

Some of the Factors That Affect the Quality of Concrete —Amount of Mixing Water Used Is Most Important Item—Effect of Mixing Water on Strength of Concrete —How to Get Concrete of Predetermined Strength— The Slump Test

Part III—How Much Mixing Water to Use

Previous discussions of the various factors affecting the quality of concrete have shown how to test aggregates to be sure that they are suitable for making good concrete and how to allow for the bulking effect of moisture in the aggregates.

The next and most important step in making quality concrete is to determine how much water to use in the mix. That is the subject of this chapter which continues the articles written for the non-technical man on how to make good concrete.

TOO much mixing water weakens concrete. In fact, the amount of mixing water used is probably the most important single item in making good concrete.

Most concretors understand the need for measuring the amount of cement used very accurately and they consider this one of the most important ingredients in concrete. But when it is realized that the addition of each pint of water above the proper amount has the same effect as leaving out a quart of cement, it will be seen that water is an even more important material than cement in the mix. It must be measured as carefully as all the other materials used.

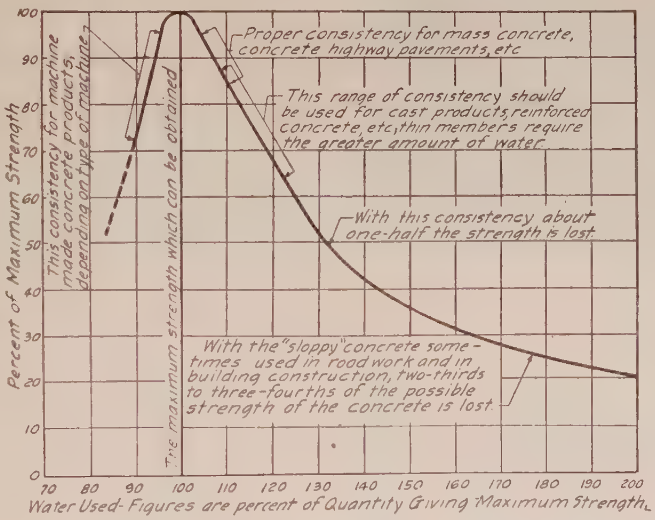


Figure 1

It has definitely been proven that the strength *of concrete depends on the amount of water used for each sack of cement.* Many laboratories have made experiments on this problem and have found the results to be the same. The "water-cement ratio law" is the result of these experiments. It is simply, that "the strength of concrete depends on the ratio between the volume of mixing water and the volume of cement."

The curve shown in Figure 1 illustrates the effect of mixing water on the strength of concrete clearly and simply. The highest point on the curve illustrates the maximum strength that can be obtained. The amount of water used here is indicated at 100 per cent. When less water is used, as shown to the left of the high point, the strength of the concrete drops. When more water is used, as is shown to the right of the high point, strength of the concrete also drops.

How Much Water?

If strength were the only factor to be considered, just the right amount of water to get the greatest strength would be ideal. But there is another factor that must be considered and that is *workability.* If just enough water were used to get the greatest strength, the mix would be too dry or "stiff" for easy handling. The point is to get the concrete as near as possible to the high point of the curve and yet not sacrifice workability. By using the minimum amount of mixing water necessary to produce the required workability, a high percentage of the greatest strength can be retained.

The correct selection of the quantity of mixing water to be used requires a careful study of the conditions under which the concrete is to be used. First, there is the question of strength. On the average job, where reasonably careful measurements of materials are made, and other operations are carefully watched, the following strengths can be expected in 28 days for the amount of water indicated:

Compressive Strength at 28 days, pounds per sq. in.	Quality of Mixing Water, gallons per sack of cement
1,500	8 to 8½
2,000	7 to 7½
2,500	6¼ to 6¾
3,000	5½ to 6
3,500	4¾ to 5¼
4,000	4½ to 4¾

From this it will be seen that if concrete having a compressive strength of about 2,000 lbs. per sq. in. (the average requirement for building construction) is desired, from 7 to 7½ gallons of water must be used with each sack of cement.

These quantities of water *include the moisture in the aggregates.* A simple method of computing this will be shown later in this article.

In general construction work, a plastic mixture is needed to permit placing the concrete in the forms and around the reinforcing bars. Some classes of work require a more plastic mix than others. For instance, concrete placed for road or street pavements can be much drier than that used for columns in a reinforced concrete building.

In the manufacture of concrete products, such as block, brick or tile, the tendency is to use less water than will give the greatest strength. The need for using a mix that will stand up when the unit is removed from the machine, is the reason for this. The water content used in this class of work is indicated in Figure 1 by the curve to the left of the highest point.

Effect of Proportions on Consistency

The mixing water used must do two things. First, it must cause the concrete to harden, and second, it must produce a workable consistency. Rich mixtures require less mixing water per sack of cement than lean mixtures because the smaller volume of aggregates requires less mixing water to give it a plastic consistency.

When more mixing water is needed to gain greater plasticity, the required strength can be obtained only by using more cement, that is, by using a richer mixture. Therefore, rich mixtures that appear to be wet, attain the desired strength because the ratio of the amount of water to cement is maintained. (See Figure 2.)

How to Measure Consistency

Consistency is easily measured and regulated by a simple field test known as the "Slump Test." The "slump" is the change in height, upon the removal of a form, of a cone of concrete, as shown in the accompanying illustrations. Through the use of this test, the amount of mixing water used on the job can be regulated very closely.

The slump test is a convenient method of measuring consistency

The only apparatus needed to make the test is a sheet metal form, shaped like a cone, the point of which has been cut off. The hole at the top should be 4 inches in diameter. That at the bottom, 8 inches, and the height of the form, 12 inches. Besides this form an iron rod for tamping the concrete in the form and a rule are needed.

To make the test, fill the form with concrete, placing it in layers of about 4 inches and working each layer with the tamping rod. Then lift off the form and measure the settlement or slump of the concrete as shown in the illustration.

Concrete having a slump of from ½ inch to 1 inch contains only a little more water than that giving the greatest strength, but such concrete is too stiff for most work.

The following recommendations of the Joint Committee on Concrete and Reinforced Concrete may be useful as a guide in selecting the maximum slump for the class of work to be done.

Type of Concrete	Maximum Slump (inches)
1. Mass Concrete	3
2. Reinforced Concrete	
(a) Thin vertical sections and columns	6
(b) Heavy sections	3
(c) Thin horizontal sections	8
3. Roads and Pavements	
(a) Hand finished	3
(b) Machine finished	1
4. Mortar for floor finish	2

From this table determine the slump you want to use—that is, the minimum slump that will give the consistency required. Test the batches frequently to check the slump and increase or decrease the amount of water used to keep the slump wanted.

Making a slump test

The selection and proportioning of the aggregates will also have some effect on the workability of the concrete. This will be discussed in a future chapter.

Allow for Water in Aggregates

As has been mentioned earlier, the quantity of mixing water used *must* take into account the water carried as moisture in the aggregate, particularly the sand. Under average conditions, the amount of moisture carried in each cubic foot of sand or coarse aggregate is approximately as shown in the following table:

MOISTURE IN FINE AGGREGATE

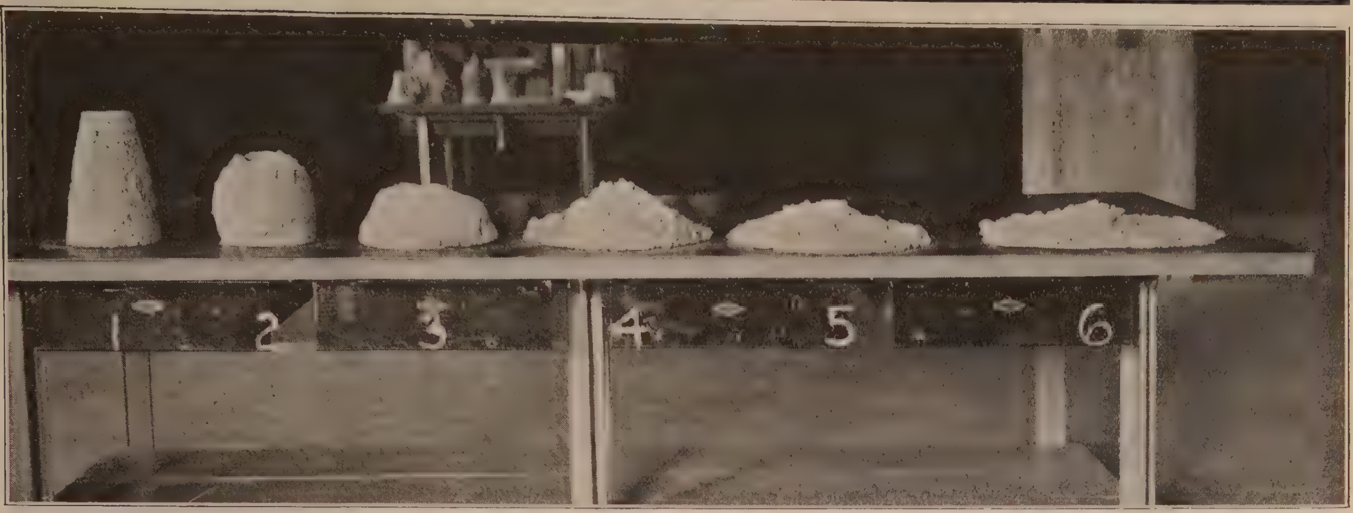
Condition of Aggregate	Gals. per cu. ft.
Dry	.2
Damp	.6
Wet	1.1

MOISTURE IN COARSE AGGREGATE

Condition of Aggregate	Gals. per cu. ft.
Dry	.0
Damp	.1
Wet	.4

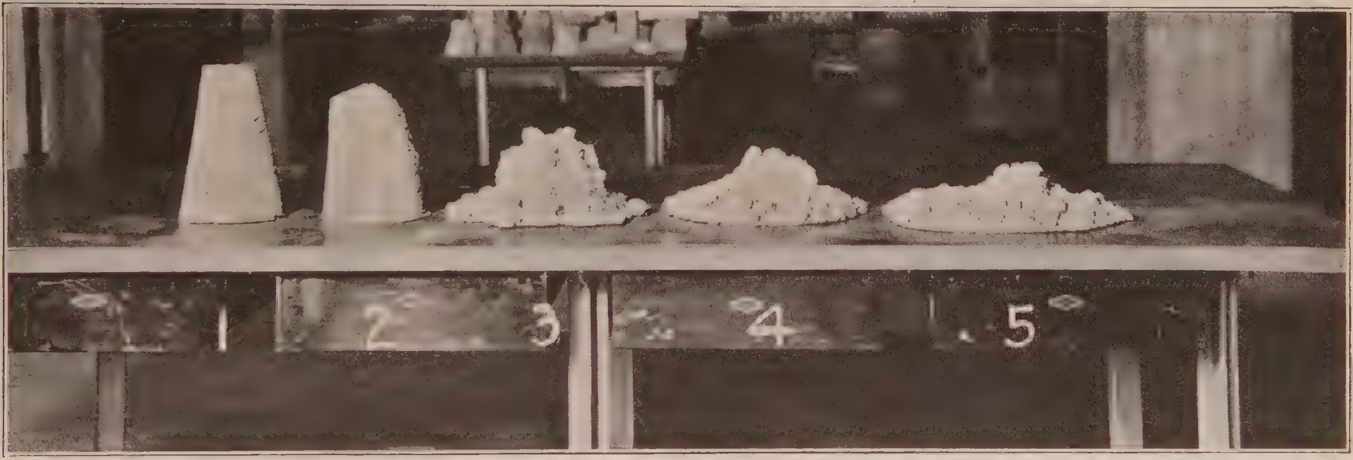
By using this table, it will be easy to determine the amount of water to be used for each bag of cement in the mix.

Using, for example, a 1:2:4 mix, with damp aggregates, for concrete which should attain a strength of 2,000 lbs. per sq. in. in 28 days. From our first table, we see that for 2,000 pound concrete the *total* amount of mixing water to be used is 7 gals. for each sack of cement.



Specimens	1	2	3	4	5	6
Water, in gallons per sack of cement	7	7	7	7	7	7
Mixture, by volume	1:2½:4	1:2½:3	1:2½:2	1:2:4	1:2:3	1:1½:2
Slump, in inches	1	5¼	7½	7	8½	9½
Strength, lbs. per sq. in.	3980	4050	4110	3960	4290	4120

The first illustration shows a series of six slump tests, ranging from 1 inch to 9½ inches, made from six mixtures in which the water cement-ratio was uniform but the quantity of cement and aggregates was varied from 1:2½:4 in the specimen on the left to 1:1½:2 on the right. Cylinders made from the corresponding mixtures and tested at the age of 28 days indicated fairly uniform strengths, as would be expected. The highest strength was 4290 lbs. per sq. in., the lowest was 3960 and the average was 4090



Specimen	1	2	3	4	5
Water, in gallons per sack of cement	6	6½	7	7½	8
Mixture, by volume	1:2:4	1:2:4	1:2:4	1:2:4	1:2:4
Slump, in inches	¼	2¼	6½	7	8½
Strength, lbs. per sq. in.	4000	4850	4030	3320	2540

The second illustration shows a second set of five slump tests, with a range of slump from ¼-inch to 8½ inches. In this set uniform proportions of 1:2:4 were maintained but the water-cement ratio was varied from 6 gallons of water per sack of cement in the specimen on the left to 8 gallons per sack in the specimen on the right. In this instance the 28-day tests on cylinders made from the corresponding mixtures indicated great variation in strength. The cylinders having a water-cement ratio of 6½ averaged 4850 lbs. per sq. in. From this value there was a progressive decrease in strength, to the point where the cylinders with a water-cement ratio of 8 had an average strength of only 2540 lbs. per sq. in. The 6-gallon ratio did not produce a plastic mixture with these proportions and therefore the water-cement ratio strength relation does not apply

Figure 2

Turning now to the tables above, we can determine how much of the required water is *already present in the aggregates.* Two cubic feet of damp sand are used for each bag of cement. The table shows .6 of a gallon of water present in each cubic foot of damp sand. Therefore, two cubic feet of damp sand will contain 1.2 gals. of moisture.

Similarly, for 4 cubic feet of coarse aggregate, we find that .4 gals. of moisture are present. The moisture in the aggregate is, therefore, 1.2 plus .4 or 1.6 gals. Then, since the total amount of mixing water to be used is 7 gals. only 7 minus 1.6 or 5.4 gals. of water should be added at the mixer.

Careful attention to this matter of keeping the mixing water down to the proper amount and keeping the water content *constant for each batch* will do more to secure a good quality of concrete than any other one item.

Chutes Place Concrete on Steep Slopes

AN interesting problem that faced the contractors building the new sewage disposal plant for Oklahoma City, Okla., was the development of a method that would economically place concrete on the sloping sides of the hopper bottoms.

The plant consisted of two batteries of two-story Imhoff tanks, each battery having eighteen hopper bottoms. The hoppers were 28 feet square at the top and reduced to 2½ feet square at the bottom in a depth of eight feet, making a slope of approximately 1½ to 1.

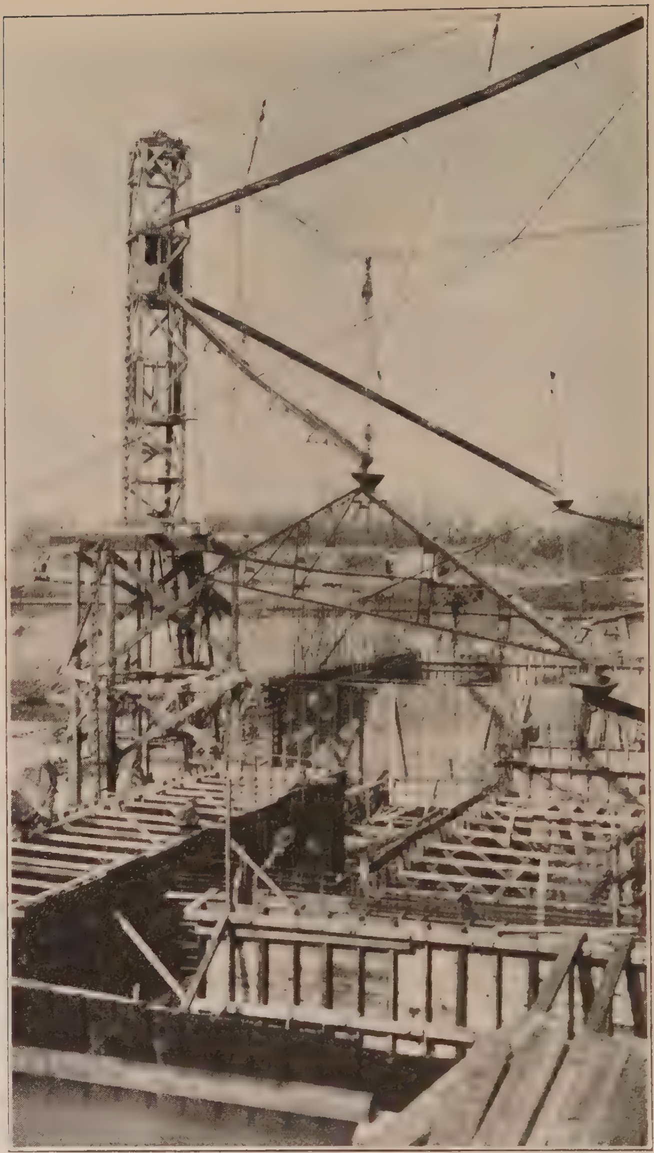
A centrally located concrete mixing plant with bins and batchers, as well as towers and chutes, was already in place for placing the concrete in the walls of one of the sections. It was thought that if this equipment were used, top forms would be necessary on the slopes of the hopper bottoms, because concrete wet enough to come down the chutes would refuse to "stay put" on the steep slopes.

Before using this method, it was decided to experiment with chuting the concrete. The contractor had been using Celite as an admixture in placing form concrete in other parts of the structure and this was also added to the stiff bottom mix in an effort to secure the plasticity needed.

It was found that the mix handled readily at the stiff consistency required to hold the concrete on the slopes. The chutes were adjusted to take advantage of the maximum fall by by-passing the second hopper in the line. With this arrangement a slope of about 1½ to 1 was obtained in the chutes. The concrete was delivered by the chutes from the mixing plant to a temporary collecting hopper near the center of the job. From this point it was buggied to the hopper bottoms.

While the slope of the chutes and that of the hopper bottoms was identical, it was found that the extra friction afforded by the sandstone formation, assisted by the reinforcement, was sufficient to hold the concrete in place.

Pease, Greeley & Hansen, of Chicago, were the designing engineers. Bert Hart was city engineer and the Boardman Company of Oklahoma City were the contractors.



An ingenious arrangement of towers and chutes made possible the economical placing of concrete

There were 18 hopper bottoms in each of the two batteries of Imhoff tanks

Practical Kinks from the Job

Some Comments on Runway Design

ONE thing on a construction job about which there seems to be much variety of opinion is the design and construction of the runways over which the two-wheel concrete carts are pushed by the laborers.

The principal requirements of these run panels are obviously that they shall be light, strong and easily handled. but these requirements apparently can be met in quite a diversity of ways. Several types of run panels are shown in the Figure 1—(b) is the panel most generally used. consisting of 1⅛ x 6 inch boards 42 inches long, spiked to three longitudinal 1 x 6 inch or 1¼ x 6 inch cleats These panels are usually made in 14 foot lengths and while somewhat heavy can be moved around on the floor by two laborers in a pinch.

An older type of run which still finds favor with some foremen, (a) is built up of 1½ inch plank running the length of the panel and held in position by cross cleats spiked to the underside.

A third form of panel which has both advantages and disadvantages as compared with the other two types is shown in (c). This panel is made the same as the one shown in (a), but is only half width. While a little more difficult to maintain in position because two are required and the center joint tends to open up and the panels to spread, the half-width panel can be handled by one man. It is also very convenient where a little greater width than the standard run panel is desired, such as at the end of the run where buggies are turned and dumped.

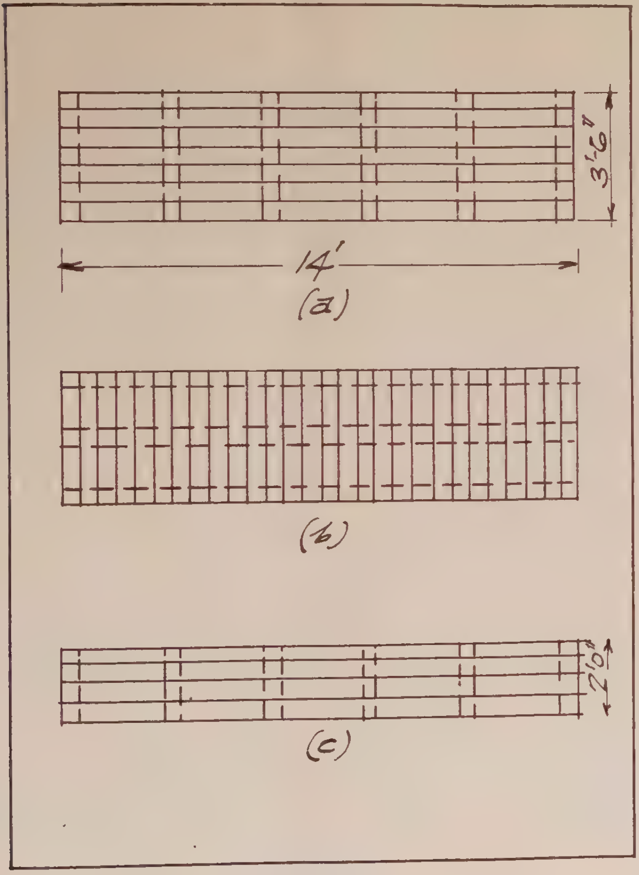


Figure 1

The most generally used form of support seems to be a chair similar to that shown in Figure 2, which consists of a 1¼ x 4 inch cross member with two legs made by beveling down a piece of 4 x 4. Where the run panels come together two of these supports may be used or the four-legged chair may be used which is also shown in Figure 2. The four legs instead of two give the run-system added stability.

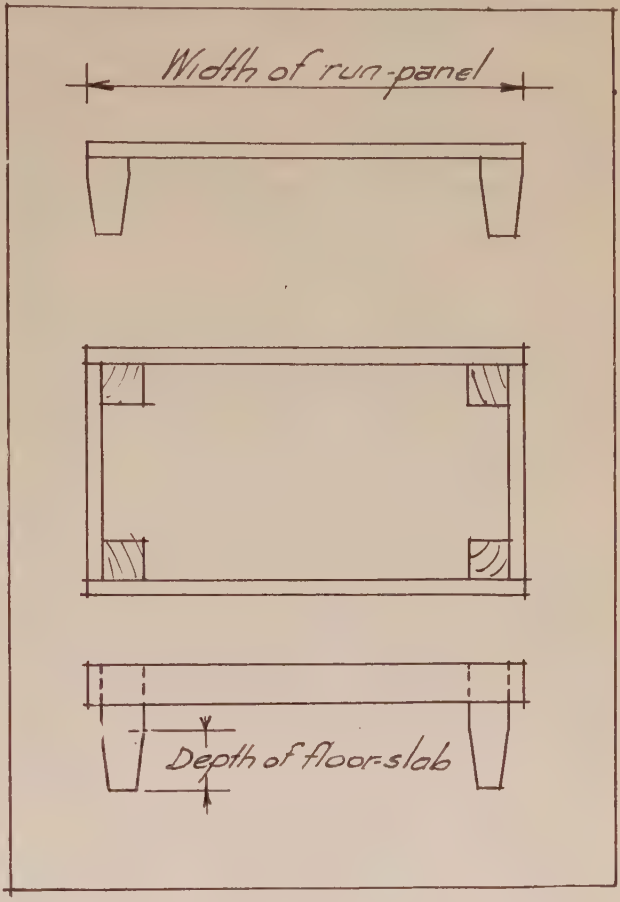


Figure 2

Various types of small horses have been tried but owing to the difficulty of getting the spreading legs out of the concrete they have generally been abandoned in favor of one of the two types sketched above.

Your Kinks, Please

Almost every concrete construction job has a problem or two, sometimes a minor detail, that can be solved better one way than another. CONCRETE will pay from $2 to $5 for every article accepted for this page telling in detail, and preferably illustrated, how time or labor was saved or a better way of doing the work was found.

Just send in the dope and the photograph or sketch. We'll do the rest.

Here and There

Some Random Notes on Visits with Concretors in the Field

HAVE you ever considered the excavating contractor as a good lead for possible jobs? He is the first man on the job in erecting a building and he can tell you of other jobs he is figuring on. Maybe it would be worth while to swap information with him.

❖ ❖

IN a Southern city union labor has gone on a strike because it was announced that a central mixing plant would be established in that city to sell ready-mixed concrete. The Building Trades Council maintained that the establishment of such a plant would throw 400 mixer men out of work!

The newspaper report said that each mixer in the central mixing plant can do the work of 400 men and that only two men are required to operate the new plant! That's selling the idea of a central mixing plant, wot?

❖ ❖

AN alert concrete block salesman dug up a new field for his products the other day. On some of the larger industrial and commercial buildings in his sales area they use a 16-inch monolithic concrete basement wall. He suggested the use of two 8-inch concrete block instead, sold the city building commissioner on the idea and is now selling a lot more block.

❖ ❖

THE Florida products manufacturers have petitioned the governor to investigate their claim that concrete products structures are being discriminated against by the tornado insurance men. In some instances they are cancelling insurance written on buildings of concrete units and they are charging exhorbitant rates for such insurance if they will write it at all. The concrete block is an innocent victim in this case of the jerry builder.

❖ ❖

IT pays to smile in business. A concrete products manufacturer told me the following story about a sale he made and how he got the buyer as a steady, profitable customer.

This particular contractor had been buying his block from a competitor of the man who told the story. But one day he came into the office and ordered some block for a basement to be built way over on the other side of town. The haul was so far that the block manufacturer couldn't see where he was going to make a profit on that particular job, but he entered it on the books, thanked the contractor for the order, smiled and started to deliver the block.

As the job went along, he took particular pains to visit it and always greeted the contractor pleasantly just as though he were making money on that sale. The contractor said nothing but went ahead finishing his job.

A little while after the job was done, the same contractor came into the office and ordered a lot of block for a group of houses he was building not a mile away from the products plant. Here was an order with a profit! "You were darn decent about that other job of mine and I have decided to tie up to you," he said when he gave the order. Now he is one of that products manufacturer's best customers.

When you are pinch hitting for another products manufacturer it pays to give that job just a little extra attention.

❖ ❖

THE color of a concrete block has an important relation to its salability. In one city, one of the concrete block manufacturers turned out a light-colored block. In selling it, he stressed the fact that such a block made a very attractive, light and airy basement wall. It went big, and other manufacturers in that town were forced to follow suit because everybody wanted a block with a light color.

❖ ❖

HERE is a clipping from a newspaper that will interest concrete products men. The location of the city and the names of the men concerned are, of course eliminated.

"Eugene————, chief municipal building inspector appeared before Alderman———— on Wednesday and lodged complaint against————————, concrete block manufacturers, charging them with violating the city ordinances.

"Concrete blocks turned out by the company failed to pass the tests prescribed by the municipal building inspection bureau and the chief inspector served notice that they were not to put any of their products on the market until they were brought up to requirements.

"The building inspector found that some of the defective blocks were going into an addition to an east side store structure and suspended operations at once. His next step was to swear out a warrant for the makers and they will now have a hearing before Alderman ——————at some convenient time."

That building inspector is to be congratulated for taking such action to insure the use of quality products in his city. He is doing a favor to the building owning public and to responsible block manufacturers as well. It is to the interest of everybody concerned, except the offender, that such action be taken. Florida block manufacturers would have been spared a lot of trouble if similar instances would have occurred there during the building boom.

❖ ❖

IT is easy to neglect the old, steady, reliable customer who keeps on phoning in his orders for concrete block, even if the salesman does not go out and see him. Keep on cultivating him. It won't take much time and it may prevent losing him.

And don't neglect the small customer, while we are talking about it. A lot of small customers use a big volume of block, taken together. And then, they usually are good pay.

❖ ❖

SINCE Lindy, Byrd, Chamberlin, Maitland, et al, did their stuff, there is a rapidly growing demand for more flying fields. Might be that you could promote a good job in your city and at the same time do something for the old home town.

A. S. T. M. Discusses Cement, Aggregate and Concrete Quality

Concrete and the Materials With Which It Is Made Occupy Important Position on Program of 30th Annual Meeting of the American Society for Testing Materials

A DIVERSITY of factors influencing the quality of concrete, ranging from cement quality to central mixing plants, were discussed at the thirtieth annual meeting of the American Society for Testing Materials held at French Lick, Indiana, June 20th to 24th, inclusive.

The increasing interest in cement quality and cement chemistry manifested by users of this product was evidenced by the interest displayed in this subject and by the papers and reports submitted. Throughout these discussions the question of the relation of chemical composition of cement to 3-day as well as 7- and 28-day tests was in the foreground.

Cement

A progress report of an investigation now under way in 52 co-operating laboratories was reported by Committee C-I on cement. The investigations have as their aim the development of a better method of making compression tests for cement than the present standard mortar briquette tests.

The possibility of developing a one- and three-day strength test for portland cement was also studied.

Though the reports of all the co-operating laboratories are not yet in, the conclusions of the committee thus far are that the use of fluid cement mix containing about 41 per cent of water by weight of cement seems to be most suitable for a compression test. It was also found that this method presents the possibility of a 3-day test with fairly uniform results.

Papers on the subject of cement composition were presented by P. H. Bates of the U. S. Bureau of Standards and by Prof. Jasper O. Draffin of the University of Illinois.

Dr. Bates' paper on "Long Time Tests of High-Magnesia Portland Cements" discussed tests made with cements manufactured twelve years ago by the Bureau. Its purpose was "not to show the advisability of allowing a greater magnesia content in cement, but only to determine how greater amounts of magnesia affect the constitution and properties of cement of normal composition."

In his conclusions Dr. Bates pointed out that his tests showed that "cements containing as much as 7.5 per cent of magnesia are satisfactory. With higher amounts, the strengths developed decreased with increased magnesia, but even with the high magnesia cements there is a notable increase of strength with age."

Professor Draffin's paper on "The Tensile Strength of Portland Cement Constituents" presented a method of estimating the strength of portland cement at various ages from a study of the variation in the strengths of its three principal constituents—tricalcium aluminate, tricalcium silicate and beta dicalcium silicate. He said, "It is generally supposed that the 24-hour strength of cement is due chiefly to the tricalcium aluminate, the 30-day strength to tricalcium aluminate and tricalcium silicate, and the increase after this period to the dicalcium silicate."

The purpose of the paper was not to present a method that could be used under all conditions to estimate the strength of portland cement from its chemical composition, but to call attention to the possibility of a fairly close relationship between the two.

Concrete

Methods of testing concrete aggregates were discussed in several papers and reports. Sub-Committee V of the committee on concrete and concrete aggregates submitted a report on its studies in preparing a test for determining the soundness of aggregates. Sub-Committee X reported its findings in studying causes of disintegration of concrete.

Sanford E. Thompson and Miles N. Clair presented a paper reporting experiments made on the use of Lumnite cement for accelerated strength tests for sand. They found that "the Lumnite cement 24-hour mortar test for determining the quality of fine aggregate for concrete gives results comparable with those obtained by the portland cement mortar test at 28 days." Such tests are of value when information concerning the quality of fine aggregate must be secured within 24 hours. These tests should, of course, be checked by portland cement tests later.

R. W. Crum, of the Iowa Highway Department, presented the leading paper in a symposium on field control of the quality of concrete arranged by C. M. Chapman. Mr. Crum and R. A. Nelson of the University of Wisconsin dealt with methods of proportioning aggregates, comparing the various methods now in use.

Duff A. Abrams discussed "Mixing of Concrete," recommending that further studies be made on mixing methods and the effect of mixing time on the quality of concrete.

Practical construction problems were considered in papers by N. L. Doe of the Turner Construction Company, "Conveying and Placing Concrete," by R. L. Bertin of the White Construction Company on "Construction Joints and Expansion Joints," and by F. H. McGraw of Dwight P. Robinson Company, on "Cold Weather Construction."

The subject of "Transverse Tests as a Criterion of the Quality of Concrete" presented by H. S. Mattimore of the Pennsylvania state highway department, caused a great deal of discussion. Modulus of rupture tests, such as those described in this paper, have practically replaced the old compression strength tests in the concrete highway field. By testing the strength of concrete pavement by this method, concrete pavements have been opened in five days against the usual 28-day curing period. While the discussion brought out a note of caution in relying solely on the transverse tests, this method has been used with satisfactory results in a number of states.

New Officers

New officers elected for the coming year are Prof. H. E. Moore, University of Illinois, president; T. O. Lynch, Westinghouse Electric and Mfg. Co., vice-president. F. O. Clements, General Motors Corporation, W. H. Klein, Penn-Dixie Cement Corporation; F. C. Langenberg, Watertown Arsenal, and F. N. Speller, National Tube Company, were elected members of the executive committee.

Reinforcing Institute Selects Best Slogans

Of the 931 slogans submitted, the Executive Committee of the Concrete Reinforcing Steel Institute selected the following: "Reinforced Concrete—Economical and Enduring," submitted by Earle Thomas, of the Pueblo, Colo., office of the Colorado Builders Supply Co., and awarded the first prize of $100. The second prize of $50 was voted to Wm. S. Thomson, Chief Engineer of the Kalman Steel Company, Chicago, for his slogan—"Build in Concrete—Reinforce with Steel."

Some Experiences in Concrete Control

Some Factors Affecting Uniformity in Field Concrete—Field and Laboratory Experiments

By R. T. GILES

Physical Testing Engineer, North Carolina State Highway Commission

NO doubt the most severe and justifiable criticism of concrete is its lack of uniformity. This non-uniformity is caused by the following:

(1) Inaccurate measurement of fine aggregate.

(2) Segregation of coarse aggregate.

(3) Inaccurate control of water.

(4) Variation in concrete making quality of cement from the same mill. The possibility of this variation is increased when cement is used from several mills on the same job.

Experiments

The accompanying charts will illustrate the possibility of producing concrete of as uniform strength in the field as in the laboratory.

Twenty-four samples of sand were taken from the same pit and tested in 1-3 mortar tension, 1-2-3½ concrete in compression and transverse. While the fineness modulus of the sand varied only from 1.59 to 2.16 it was necessary to change the water very slightly on only three samples to obtain the same workability.

With the field concrete the inundation method for measuring sand was employed and the coarse aggregate was graded from ¼-inch to ¾-inch. With coarse aggregate of this size practically no segregation takes place, either in the stock pile or in the concrete.

The opportunity for non-uniformity in the field concrete was the greatest since it was made in temperatures ranging from 32 deg. to 90 deg. Fahrenheit, and the cement was from the shipments extending over several months. The cement used in the laboratory investigation was taken from one batch of cement with practically no chance for variation, the coarse aggregate was graded from ¼-inch to ¾-inch, and specimens were made at about 70 deg. Fahrenheit.

To check the first results of the use of the inundation method, cylinders were made from another job with practically identical results. A comparison of the two field jobs and the laboratory concrete follows:

	1st Field Job	Laboratory Concrete	2nd Field Job
Mix	1-1½-3	1-2-3½	1-1½-3
Gallons water per bag of cement	5¾ to 6	6½ to 6¾	6¾ to 7
Highest strength	4261	3595	4225
Average	3780	3145	3575
Lowest strength	3290	2698	3335
Extreme variation	26%	28%	25%
Average variation	6%	6.4%	7.6%

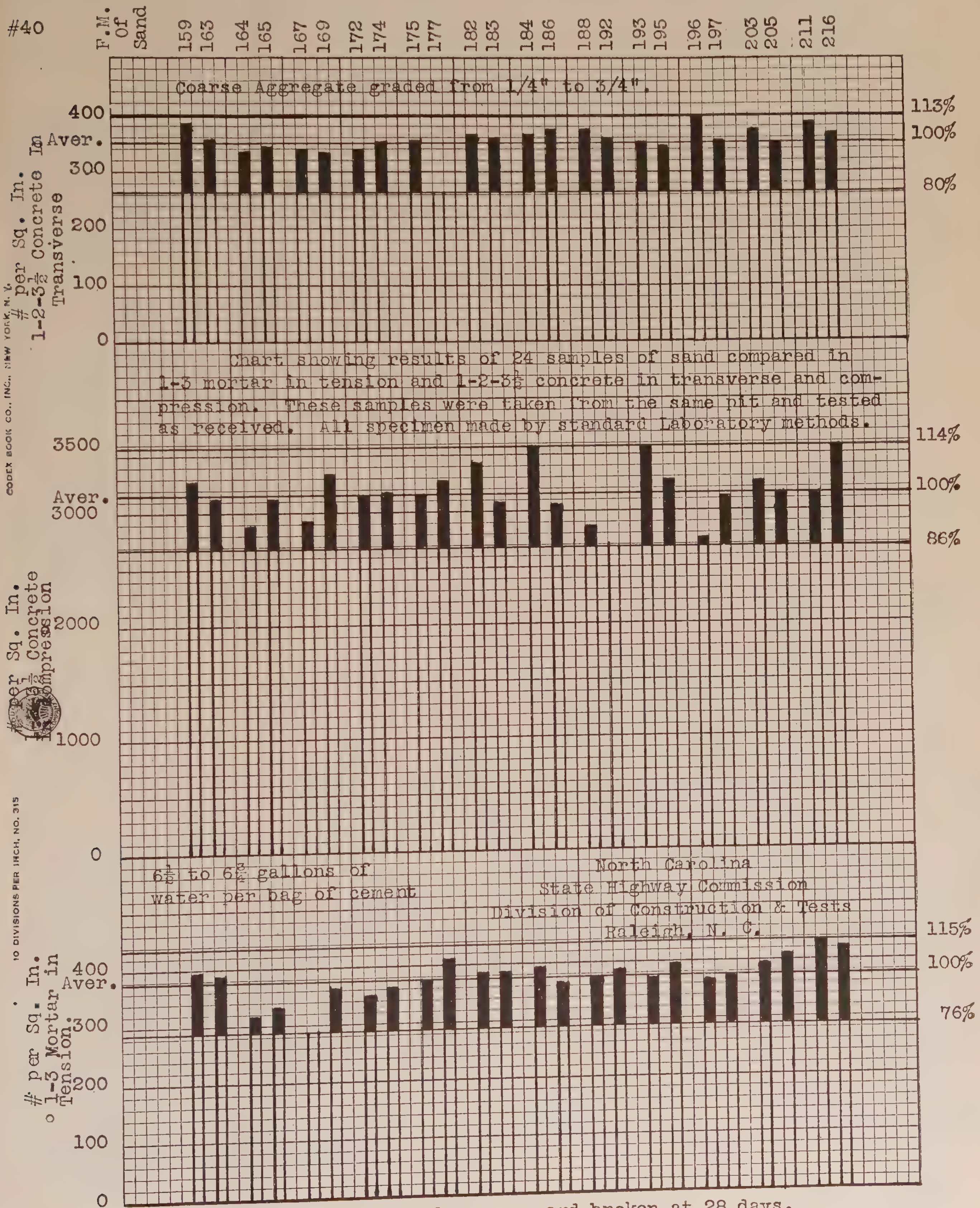
All samples were tested wet at 28 days. Laboratory specimens were placed in a damp room at the end of 24 hours. Field specimens were placed in a damp room at end of 48 hours. On the second field job a very fine sand was used which required a greater amount of water to give the same workability. The concrete in both instances was used in reinforced concrete piles and, therefore, required about the same workability.

We are now using the inundation method on several jobs and find that it has reduced the non-uniformity of the concrete considerably, but with a stone graded from ¼-inch to 2½-inch the segregation of the coarse aggregate in the stock pile prevents such close control as when the stone is limited, as was the case with the reinforced piles. No doubt with a coarse aggregate proportioned by the use of three different sizes, the non-uniformity could be reduced to approximately the same degree as with the ¼-inch to ¾-inch stone, except for the segregation which would be caused in placing.

Variations in Cement

A very striking illustration of the variation in the concrete making quality of cement developed last year. We were using the inundation method for proportioning the sand, and using one size stone to eliminate segregation. The results ran very uniform from March to the first of August. Without any change in materials or proportions the strength dropped thirty-five per cent and stayed there for six weeks, when it came back to its original strength and remained until the completion of the job. Since the tests of the cement showed no change I was unable to explain this drop until I found that the same drop had taken place in a road using the same cement, and that both the drop and the return to normal strength were about the same time on both jobs. With this experience before me, I am inclined to think that we are making a cement to meet a test instead of making a cement to make concrete.

No doubt the reader would be interested in knowing that no laboratory equipment was used on the last field job, and there was no one on the job who had had any experience in using the inundation method. The only instructions issued were to use a quart cup to ascertain the exact amount of water to add to secure the proper consistency and workability for the work, and then buy



All specimen cured in damp room and broken at 28 days.

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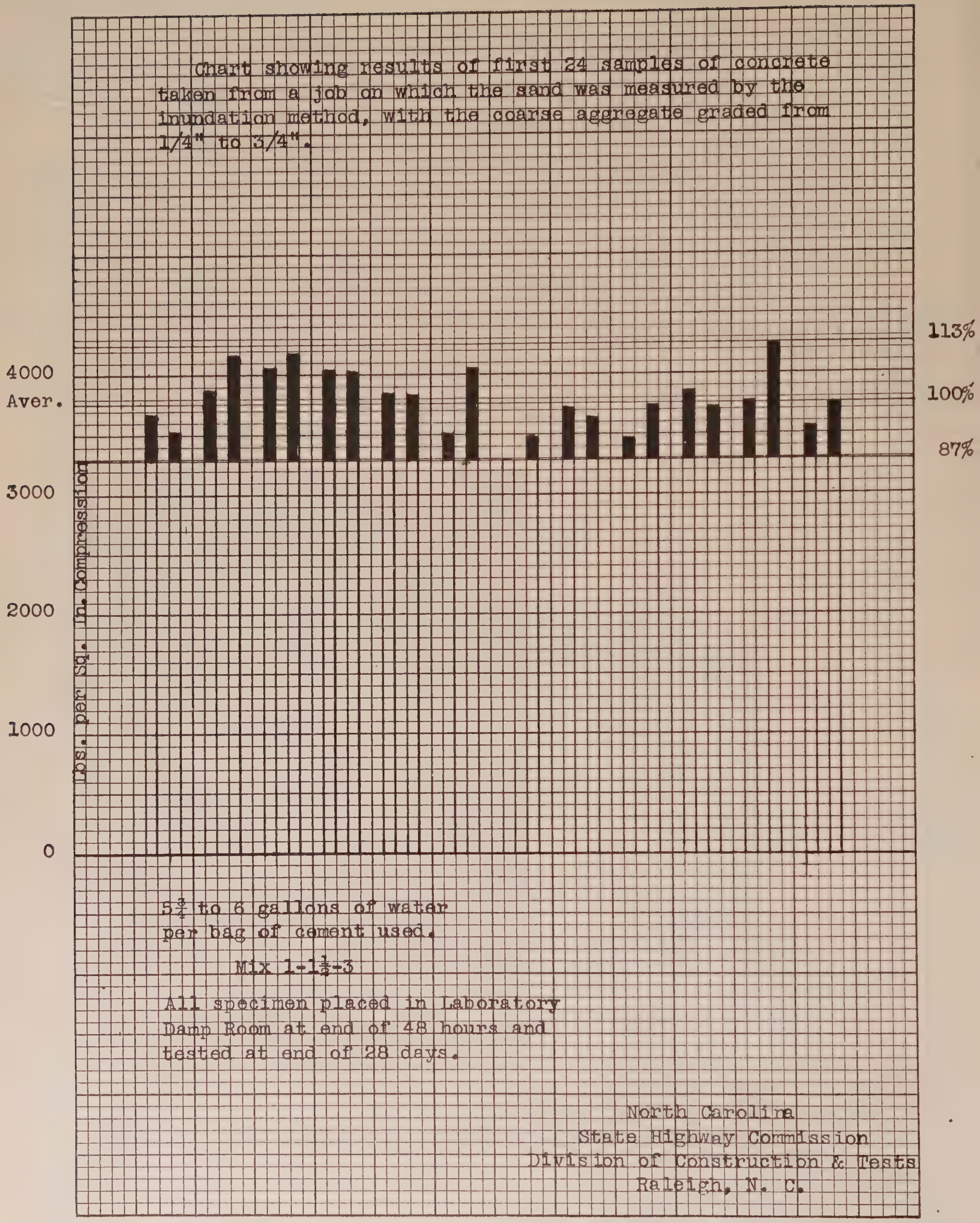


a bucket that would hold just that amount of water. This was done and no changes were made afterwards.

The next semi-annual meeting of the Concrete Reinforcing Steel Institute will be held on September 19th, 20th and 21st at the Aviation Country Club, at Detroit, Michigan.

One of the recent weekly leaflets of the Wisconsin Concrete Products Association suggests that it may be as true of the concrete products industry as it is said to be of major league baseball that "July is the turning point when weak lucky teams fall behind and the stronger teams battle it out." Was it?

How to Make—
Concrete Fence Posts

A Desirable Specialty for Concrete Products Manufacturers—Manufacturing Methods—Size of Market and Merchandising Methods—Costs—Profits—Investment Required

FROM the point of view of the products manufacturer who is favorably located and who is looking for a profitable specialty that will involve only a small initial investment, the manufacture of concrete fence posts offers attractive possibilities.

Because of their many superior qualities, concrete fence posts are rapidly growing in favor. The farmer is beginning to realize the advantages of using a post that has been estimated by authorities to have a life of fifty years or more rather than using a wood post that can only be considered temporary at the best.

Estimates have been made showing that over 500,000,000 fence posts are used each year in the United States. At present only a very small percentage of these are concrete posts. A ride into the country will demonstrate very forcibly the potential market for this concrete products specialty. A plant, favorably located, need not look far afield for a market, if aggressive merchandising methods and quality manufacturing methods are used.

Types of Concrete Posts

Concrete posts are made in a variety of different shapes. Some manufacturers use home-made forms, but the best results are secured by using the metal forms made and marketed by a number of reliable post mold manufacturers. Posts made in home-made forms are usually square. Those made in commercial molds will be triangular, round, half round or "T" shaped, according to the molds selected.

The usual lengths of posts is from seven to eight feet. The cross sectional sizes vary with the type of mold selected. A square post, having a 4- by 5-inch base and a 3- by 4-inch top has been found to give good results.

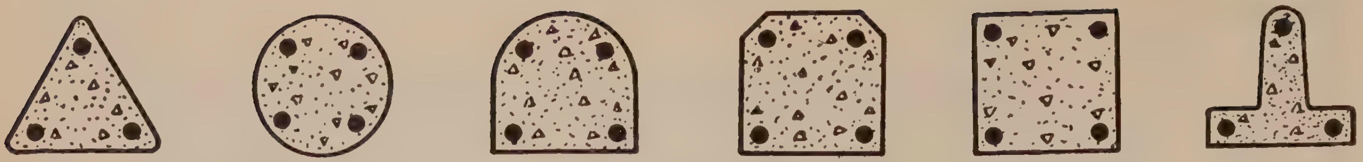
Commercial post molds, made of strong sheet metal bent to the required form produce posts that are true in shape and dimension and have a smoother surface than posts cast in home-made wood forms. Also, the mold manufacturer usually has some method of placing the reinforcement for use with his mold that will insure its staying in the proper position. This is an important item in securing the required strength.

Manufacturing Methods

It is not difficult to make concrete fence posts. But it is necessary to use care in their manufacture because the chances of failure are very large with poor workmanship and low quality materials.

A 1:2:2 or a 1:2:3 mixture has been found to be very satisfactory, depending on the grading of the materials. All material passing the ¼-inch screen is classed as fine aggregate and everything larger than ¼-inch is coarse aggregate. Coarse aggregate should have a maximum size of ¾-inch and should be well graded, that is, there should be some material of all sizes from ¼-inch to ¾-inch. In posts with very thin sections a maximum size of ½-inch for coarse aggregate is preferred. A very fine

More than 500,000,000 fence posts are used in the United States annually. Here is a farm that gave some products manufacturer a profitable order for concrete fence posts. Many other farms need them



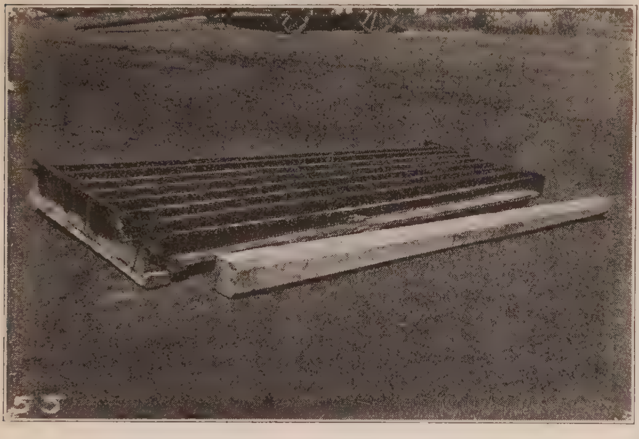
Cross-sections showing some shapes for concrete fence posts

sand is not as good as a sand containing both fine and coarse particles. Of course, the materials must be clean and hard.

The concrete should be mixed until every pebble is coated with mortar. Do not mix the concrete with too much water. A workable mix must, of course, be made, but it is not necessary to make the mix sloppy.

Before placing the concrete, the molds should be carefully cleaned and oiled. Placing concrete for such a long, thin product as a post requires especial care, if a quality post is wanted. Also, the accurate placing of the reinforcement is an important item. Most commercial equipment provides spacing devices of one kind or another for accurate placing of the reinforcement.

Practice in placing the concrete and the reinforcement in the molds varies slightly with the type of mold used. In some cases the reinforcement is made up in cages and placed into the form before any concrete is deposited, while in other cases some of the concrete is placed and tamped, after which the reinforcing rods are placed.



A group of post molds

When the mold is filled and the reinforcing is in place, the concrete is struck off and the filled molds are placed in the curing rooms.

Care must be taken to be sure that the concrete fills all the space in the mold and that it is thoroughly compacted around the reinforcing bars. Usually the molds are placed in parallel rows either on tables or trucks for receiving the concrete. As the concrete is placed the molds should be vibrated to compact the concrete. This can be done either mechanically or by tapping the molds with a hammer. The "gangs" of molds can be racked on trucks that take them to the curing room.

Curing

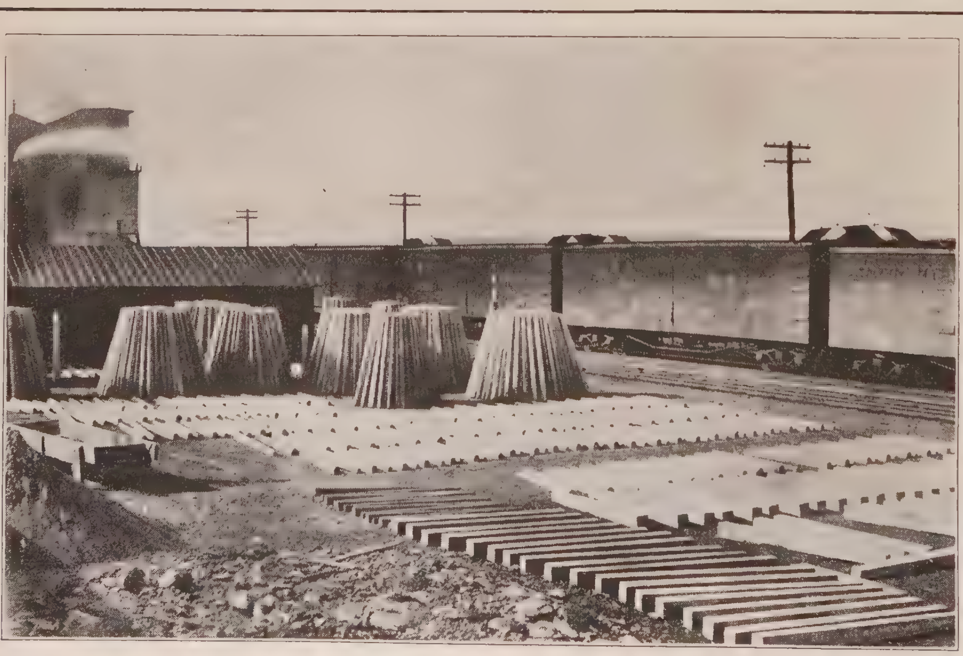
Because of their length and small cross-section, the amount of exposed surface area is very great on concrete posts. This makes careful curing a matter of great importance. If they are not kept wet for the first week, especially for the first few days after they are removed from the forms, the great surface area will permit the drying out of the water needed to harden the concrete.

After the molds have been filled, they should be stacked in the curing rooms and be undisturbed until the concrete has hardened enough to permit the removal of the forms without damage to the post. In summer twenty-four hours is usually sufficient, but in cooler weather a longer time is necessary. The concrete in the molds should be kept in a shady place, out of the wind, and ought to be sprinkled twice daily.

When the forms are removed, care must be exercised not to crack the poles. Forms should be carefully cleaned and oiled each time they are used. Do not set posts before they are at least 28 days old. A longer curing period than this is preferable if it is possible.

Corner and Gate Posts

Posts placed at the ends or corners of fence lines natur-



Many products manufacturers have found that the manufacture of concrete fence posts offers a profitable specialty ally are subjected to greater strains than those along the fence. They must resist practically all of the pull exerted by tightening the line wires in the fence. As a result special provisions must be made for posts in this position. In some cases larger and stronger posts are used, while in other cases braces, such as shown in one of the illustrations, are used. The process of manufacture is much the same except in those cases where corner and gate posts are cast on the site.

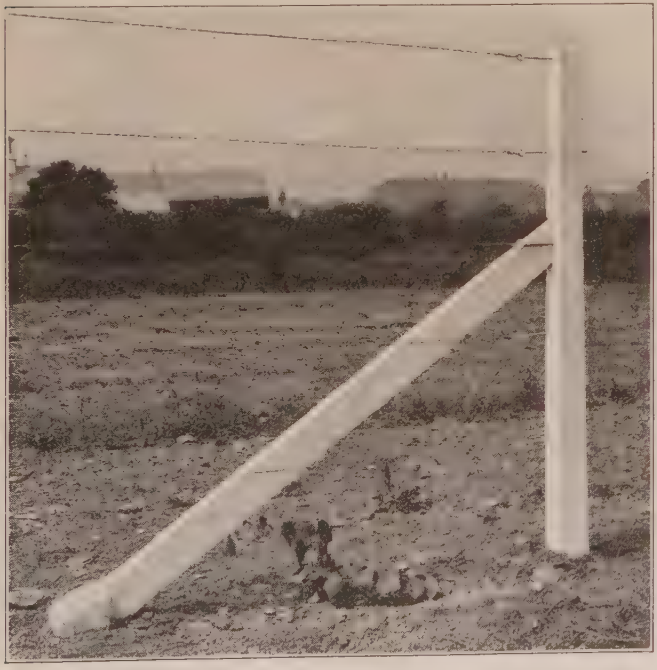
Special commercial molds for making corner and gate posts are available.

An entire fence of precast concrete units

Attaching Wires

A simple and practical method of attaching the fence wires to the concrete posts is to tie them to the post with short pieces of light wire. One end of the wire is twisted about the line wire. Then the other end is passed around back of the post and also twisted about the line wire. This arrangement holds the line wires securely in place and has the advantage of being performed quickly and easily.

In some of the posts made in commercial molds, special provisions are made for fastening wires.



A concrete end post and brace

Merchandising Fence Posts

One of the important problems the farmer has is keeping his fences in good condition. It is this problem that creates the market for fence posts of concrete. As previously mentioned, more than 500,000,000 fence posts are used each year. The first cost of the fence post is only one of the items of expense. They must be kept up. Wood fence posts last from 6 to 10 years only, while the length of life of a well made concrete post is indefinite. Some have been in use as long as 50 years.

Like with all other specialty concrete products, aggressive merchandising is needed to sell the posts. Personal calls and literature mailed to farmers will result in sales. Every farmer having a wood pole fence is a good prospect. But the important thing is to get the story to him. Sell him on the quality of the post, its permanence, strength and attractive appearance. Then supply a post that is well made—one that you *know* will meet the description in your sales talk. One concrete fence sold and installed will sell many others. If you know you are making a quality post guarantee it for a certain number of years. A guarantee inspires confidence.

Some manufacturers market at least a part of their production through hardware stores and farm implement dealers.

The products manufacturer who is just taking on the manufacture of concrete fence posts makes a mistake if he invests in a large amount of equipment at the outset. He can begin on a small scale, say with an outfit of 20 or less molds. The equipment is not very expensive, molds of the 6 post sizes costing around $20 to $40. A dozen molds, an end mould, and other necessary equipment can be purchased for about $100.

As the post end of the business grows additional molds can be installed. The only investment needed for the man already making concrete block is for the molds. Trucks and curing rooms used for making concrete block can be adapted for post manufacture.

It costs from 35 to 50 cents to make a concrete post, depending on local conditions. It sells from 75 cents to $1.00, also depending on local conditions.

New Cup Offered in Safety Contest

The Sumner Sollitt Cup has been offered as a prize in the accident prevention campaign and contest inaugurated by the Associated General Contractors of America. This cup will be awarded to the member of any chapter in any part of the country who sets the best accident prevention record as a member of a unit entered in the Reisinger cup contest.

Effects of Weather and Heat on Concrete Tested

A series of experiments being carried on at the College of Engineering at the University of Wisconsin is designed to find how the high temperatures of the interiors of reinforced concrete chimneys act upon the concrete. Several concrete cylinders are being tested under high internal temperature conditions.

Relation Between the Characteristics of Portland Cement and Deterioration of Concrete

Continued from Page 26

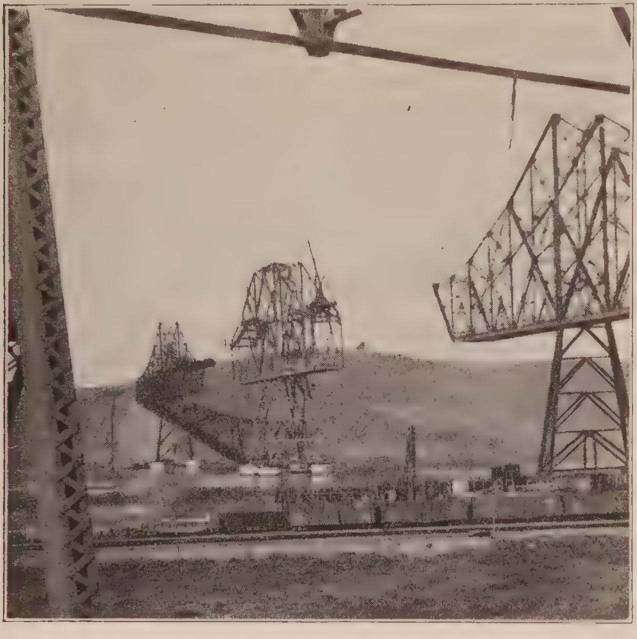
there is in keeping exposed concrete in good condition for a long time. In other words, certain of the calcium aluminates in concrete are not in a condition of stable equilibrium with some of the neutral or nearly neutral salts and disintegration is merely a matter of whether these salts can get to the interior of the concrete.

(To be continued)

World's Largest Highway Bridge Paved With Reinforced Concrete Seven Inches Thick

THE Carquinez Straits Highway Bridge, California, costing $8,000,000 and with a total length of 4482 feet, is greater than the East River Bridge, overshadows the mighty Philadelphia-Camden Bridge in length, is larger than the famous Quebec bridge and is commanding the attention of the greatest bridge engineers of the world. It connects Vallejo on the north bank of the Swift Carquinez Strait with Crockett on the south.

The length of the main bridge is 3350 feet, containing two spans 1100 feet each, center tower 150 feet, two end anchor arms 500 feet each. The clearance for ships is 135 feet above mean high water, which is enough for the largest vessels including the battleship California.

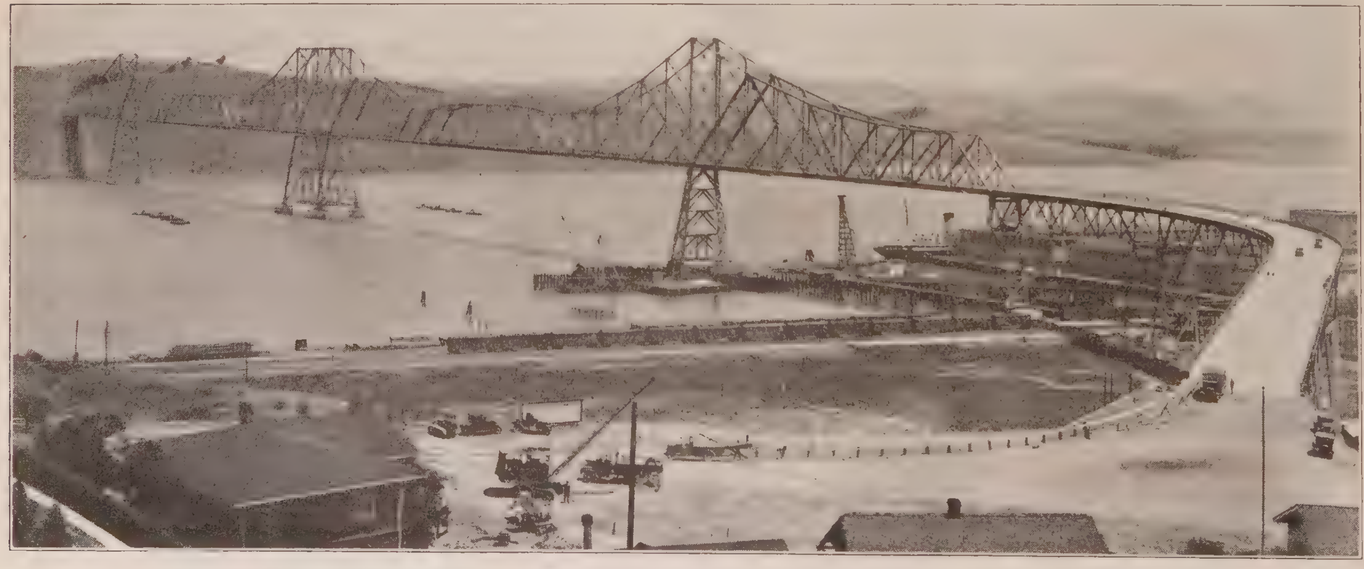


The bridge before the two 450-foot spans had been raised

Towering over the water to a total height of 350 feet above the surface, with massive towers equal in height to a 22-story building, the huge reinforced concrete piers on which the bridge rests stand in 100 feet of water and sink below the strait bottom to sandstone rock foundation beds another 40 feet. The center pier consists of four concrete foundations each 40 x 40 feet in plan and 142 feet high. The north tower foundation consists of two concrete piers each 40 x 40 feet square and 142 feet high. There is a viaduct 1132 feet which serves as an approach on the south side.

Concrete making on north side of Strait

The two spans were fabricated near the bridge and at the proper time were floated into place and lifted by means of heavy cables and a counterweight system, consisting of boxes filled with sand to the proper weight.



The viaduct approach

Methods Used in Building a Large Concrete Dam

Rio Development Is Unit in Mongaup River Water Power Development — Construction Methods — Sequence of Operations

By **MASON T. WHITING**
Resident Engineer

THE latest step in completing the chain of water power projects along the Mongaup River in southern New York state operated by the Rockland Light & Power Company was the completion of the concrete and earth dam at Rio, about three miles below Mongaup Falls.

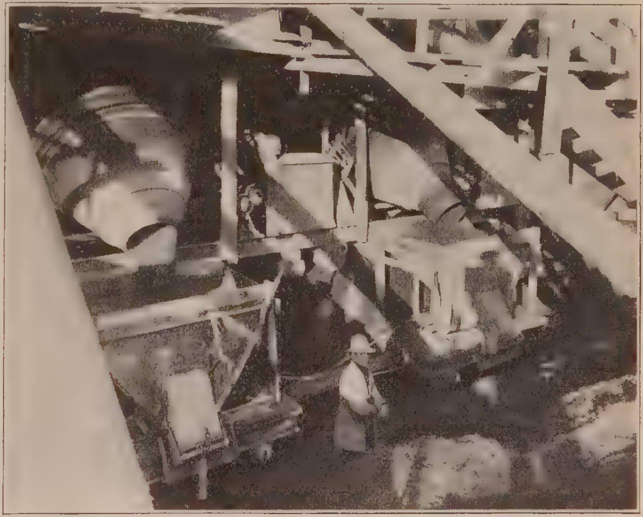
The Rio development is the third of a series of four power plants. Two of the dams had previously been completed and the fourth is projected for early construction. The fourth dam, when completed, will back water up to the tailrace of the Rio dam which will back it up to the next dam at Mongaup Falls and this, in turn, will back the water up to the first dam at Swinging Bridge. The combined gross heads of the four plants will be nearly 600 feet, and the combined wheel installation about 40,000 hp.

The Rio dam contains approximately 41,400 cubic yards of concrete and 103,000 cubic yards of earth fill. It has a maximum height of 105 feet and a length of about 1,500 feet, of which 465 feet is concrete. The county highway will cross over the dam on a concrete bridge which was built for that purpose.

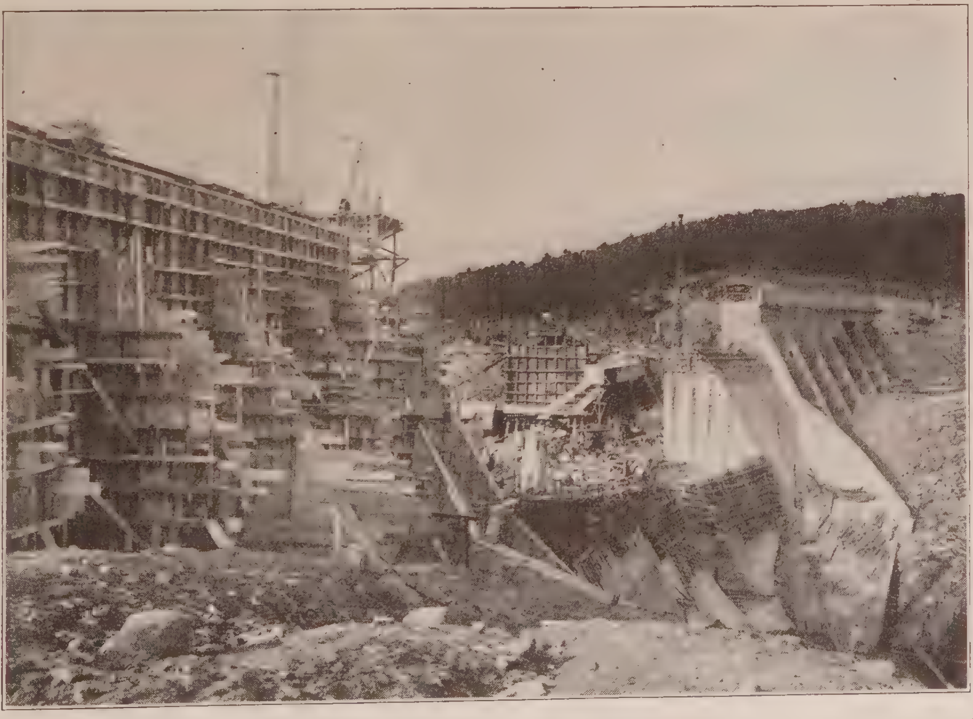
Excavation for the foundation under the dam was started in March 1926. The last concrete was placed in the dam in November, 1926, and it is expected that the plant will be in operation by November of this year.

Contractor's Plant

A simple, efficient method of placing the concrete in the dam was developed by the contractor.



The mixers discharged into cars which were drawn out over a trestle behind the dam and which dumped the concrete into the lower forms



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When the dam was built up above the level of the trestle, the concrete was taken from the cars in buckets which were elevated by two stiff leg cranes, one on each side of the river. The concrete was then dumped into an auxiliary hopper from which it was buggied to the forms

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The mixing and proportioning plant was set up, as shown in one of the illustrations, on the east bank of the river, just over the dam. Two 1-yard Smith tilting mixers, having a combined capacity of about 500 cubic yards per eight-hour day were installed under the proportioning bins. There were two bins for stone, each 13 by 40 by 25 feet in size on either side of a bin for sand, 13 by 40 by 20 feet, storing sufficient aggregate for a two days' run.

These bins fed the mixers through measuring boxes. Two Blaw-Knox inundators accurately measured the sand and regulated the water content of the mix.

The mixers discharged into 1-yard side gate cars which were drawn out over a trestle behind the dam and dumped into chutes which distributed the concrete over the base of the dam as required. Later, for placing the concrete at higher levels, the cars dumped into 2-yard buckets which were lifted by steel derricks conveniently placed behind the dam on each bank of the river. These buckets either deposited the concrete directly into the forms or into auxiliary hoppers from which it was taken in buggies and placed.

Aggregate Supply

Both sand and stone were taken from a large gravel bed located on a flat east of the river and about half a mile above the dam.

Aggregate was hauled by truck from the pit to a hopper placed under the road, just back of the proportioning bins. Here it was fed automatically onto a grizzly. All oversize stones were deflected and fed into a crusher. A 40-foot bucket elevator raised the materials to a Tel-Smith screen placed above the material bins. Aggregate passing through a 4-inch screen and retained on the ½-inch screen went into the stone bins. Everything passing the ½-inch screen was classed as sand. Oversize material was wasted in piles.

Water was added at the entrance of the screen to wash the aggregates and the sand leaving the screen first went through a washer before entering the bins.

Sequence of Operations

The first concrete was placed on June 24th under the east end of the spillway and under the east abutment.

The spillway section of the dam is of the gravity type and is 264 feet long and 90 feet high at the center. It is built on a 400-foot radius curve. Eight reinforced concrete bridge spans, resting on concrete piers, carry the highway over the spillway.

At each end of the spillway is a reinforced concrete abutment wall approximately 100 feet long with buttresses which rest on a concrete mat. The earth sections of the dam completely enclose these abutment walls.

While the concrete for the foundations of the east end of the spillway was being placed, a rock-filled cofferdam was being built to enclose the west portion of the spillway. Early in August the base for the west portion was poured. A 10 by 10-foot temporary sluice was left at the low point to take care of the water later on.

As soon as the west half of spillway and intake section on the west bank were up to a safe height, the cofferdam was torn out and a second one was built across the center gap to the east section. This turned the river through the 10 by 10-foot sluice referred to above. The last stretch of the river bottom was then prepared to receive the concrete and a cut-off trench was excavated near the heel.

Just below the cut-off trench at the heel of the dam, an 8-inch drain was placed to collect any seepage water. Cross drains, placed at 30-foot intervals, lead this water out freely at the toe of the dam. This reduces possible uplift pressure, except at the heel.

By September 20th the central portion of the dam had been built up to a safe height and the apron below the spillway had been completed. A 25-foot gap was left at a suitable level to help take care of the spring floods. After the floods had passed the water was again diverted through the 10- by 10-foot temporary sluice. The 25-foot gap was then built up in the dry without difficulty. The final step was to close the gate at the entrance to the temporary sluice and fill the hole with concrete.

The last step was to fill the center portion of the dam and to close the temporary sluice

During October, the spillway, intake and abutment walls were completed and by the end of November the bridge over the top of the spillway had been constructed. This completed the concrete work with the exception of the two openings referred to above. These were closed after the 1927 spring floods had subsided.

The spillway and wing walls were built of 1:3:6 mass concrete, the abutment walls of 1:3:6 reinforced concrete, the bridge piers of 1:2½:5 reinforced concrete, and the bridge of 1:2:4 reinforced concrete. The entire structure contains 41,400 cubic yards of concrete.

Chas. H. Tenney & Co., of Boston, were the engineers and Chas. T. Main, Inc., of Boston, were consulting engineers for these developments. Fred T. Ley & Co., Inc., of Springfield, Mass., were the contractors. The writer was resident engineer for Chas T. Main, Inc.

Coming Conventions

September 19th, 20th, 21st—Concrete Reinforcing Steel Institute, at the Aviation Country Club, Detroit, Michigan. Semi-annual meeting.

January 9th to 13th, 1928—American Road Builders' Association. Cleveland, Ohio. Convention and Road Show.

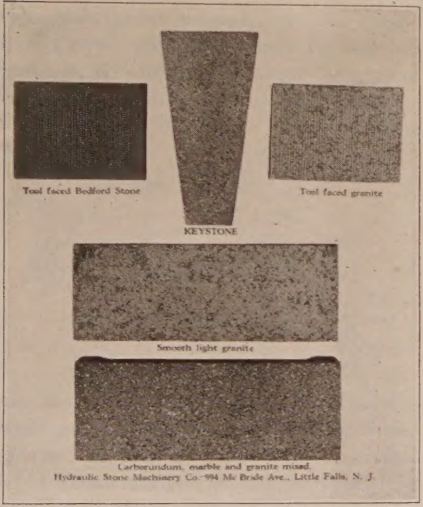
February 28th, 29th, March 1st—American Concrete Institute, at Benjamin Franklin Hotel, Philadelphia, Pa. Twenty-fourth annual convention.

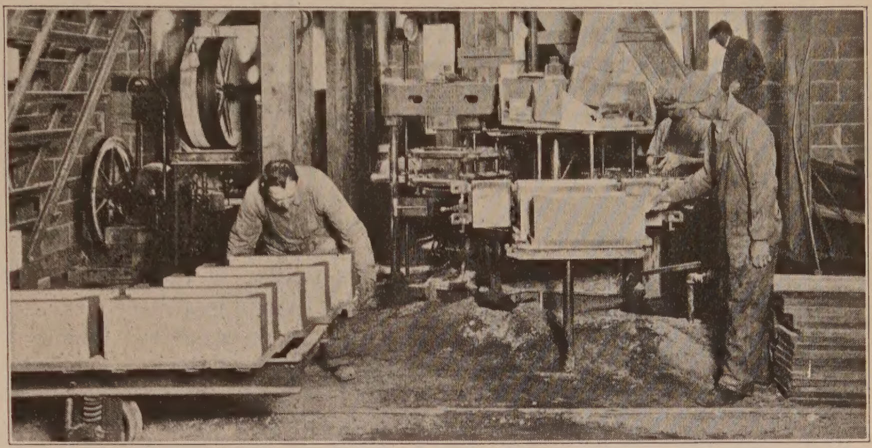
New Equipment

A Versatile Machine

A machine for making almost an infinite variety of shapes, styles, dimensions and surface treatments of concrete building units is now being marketed by the Hydraulic Stone Machinery Company, 228 N. LaSalle St., Chicago.

The machine can quickly be adjusted for making either the standard wall units, trimstone, or special shapes. It does almost anything in manufacturing concrete building units but carving the stone. Wall units, veneering slabs, water tables, corners, coping, columns, lintels, panels, keystones, window and door caps, chimney and fireplace stones—all can be turned out with this machine and the attachments that go with it.


Tool faced Bedford Stone
KEYSTONE
Tool faced granite
Smooth light granite
Carborundum, marble and granite mixed.
Hydraulic Stone Machinery Co.-994 Mc Bride Ave., Little Falls, N. J.

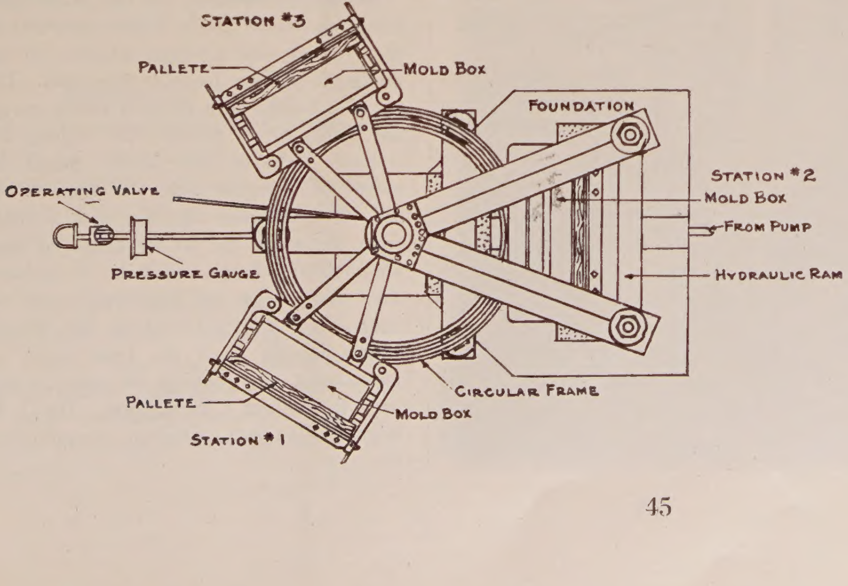


It is not a block machine and the product it turns out is not a concrete block. It is different in shape and is made by an entirely different manufacturing process. The machine compresses the concrete hydraulically and the entire operation is automatic. It can turn out from 500 to 2,000 units per day, depending on the shape and size of the units manufactured.

The machine consists of three mold boxes mounted on a revolving table with three fixed stations, one for charging, one for ramming and one for removing the finished stone. All are in operation at the same time, using two men to operate the machine. First the facing is spread over the face plate, then a semi-wet mixed concrete is charged on top and the mold rotates to the ram. Here a pressure of 35 tons compresses the concrete, the ram operating at the rate of 200 rams per minute. While this is taking place, a second mold box has been brought by the rotating frame to the charger and a third to the delivery. Here the stone is taken from the machine, sprayed to wash all foreign materials from the facing and taken to the kilns for curing.

The manufacturers call the product of this machine "Reconstructed Stone." The product has been used on some very important buildings. The units supply the structural frame of the wall and at the same time present an attractive outside wall surface of an infinite variety of treatments both in color and texture. The other half of the unit can be faced with another type of material and serve as the inside wall treatment.

WORKING PLAN



Ornamental Floor and Sidewalk Tile Machine

Inlaid floor and sidewalk tile, for use in hotels, theaters, fireplaces, panel work, and public buildings, are produced on the Rapid Action Tile Machines manufactured by the Duncan Machine Works, Boone, Iowa.

Operation is quite simple. Machines are made for 8x8 inch tile, 12x12 inch, 24x24 inch, as well as 18 inch hexagonal and half hexagonal. All types may be changed to plain tile by omitting the center core. In bottom of inlay section one-third of thickness of tile is left for the base.

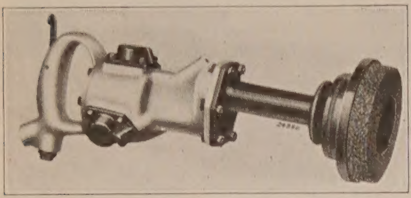
New Convertible Paver and Building Mixer

A mixer has been developed for small paving jobs, curb or curb and gutter work, and for large floors which is available in two sizes—capacities of either 30 to 90 yards per eight hour day or from 60 to 125 yards per day. It may be changed in a few minutes from end discharge to side discharge. The mixer resembles a miniature paver and is equipped with a standard power loading skip and with a swing spout and distributing chute which can work through an arc of 180 degrees. The Marsh-Capron Company of Chicago is the manufacturer.

New Equipment

New Surfacing Tool

The Ingersoll-Rand Company, New York City, has placed on the market a surfacing machine for green or old concrete that is equipped with a ring-shaped grinding wheel.



The grinding wheel is held in a wheel head by one side with the other side open for grinding. A flexible joint is provided in the wheel head to keep the grinding wheel from tipping on edge. Weight of the tool is 13 pounds.

Hand-Power Tile Machine from the South

A hand-power machine turning out a tile testing more than 1,000 pounds per square inch in smooth-faced, 8 x 8 x 16-inch and 8 x 8 x 8-inch half tile is offered on the market by the Southern Equipment Company, Sanford, Florida. A twenty-minute change on the machine produces either size. A wet mix is used.

As high as 600 high-grade tile have been made per day by one man using a power mixer.

Accurate Pipe Produced on Martin Machine

Although the sale and installation of the Martin concrete pipe machine have been taking place for some time, the features of the machine are still worthy of mention. Pipe may be made with or without reinforcing and pass with a large margin all A. S. T. M. and local standards.

Tongue and groove, bell and spigot, or plain butt joints can be produced, with exact dimensions of the finished pipe insured. The machine can advantageously place an inner lining in pipe of a material different from that of the body of the pipe.

One particular plant on the west coast averages better than 2700 feet of 6-inch bell-end pipe in a nine-hour day, according to the machine manufacturers, the Martin Iron Works, Los Angeles, Calif.

Form Wire Cutter Does Quick Work

For cutting form wires quickly and easily the M. & M. Wire Clamp Company suggests the use of its M. & M. Wire Cutter. The wire can be fed into the cutter blades without being fed through the cutter. The tool can be bolted to a bench and gauges set for cutting wire to specified lengths. It will handle wire or mild steel rods up to ¼-inch.

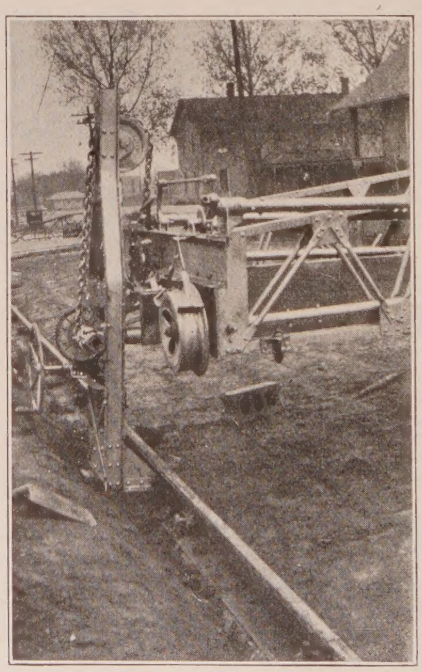
Six-Cylinder Engines Now on Foote Pavers

The Foote Company, Inc., of Nunda, N. Y., is now installing, in addition to conventional four-cylinder engines, six-cylinder engines as standard equipment on its pavers. Higher speeds without excessive engine wear are possible due to the reduced weight of the reciprocating parts of the engine.

New Jack for Finishing Machine

A special jack for mounting the transportation wheels on finishing machines has been developed by The Lakewood Engineering Company, Cleveland, Ohio.

This jack enables the contractor to quickly remove or install the transportation wheels on the job. The illustration shows how the finisher is raised and lowered.



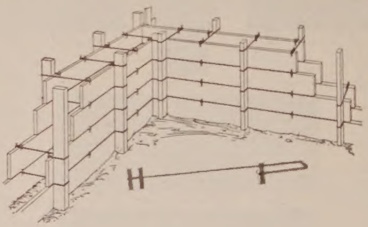
Riehle Makes Improvements on Testing Machine

Accommodation for bulkier specimens is provided by the wide table on the Riehle Three Rotating Reversed Screw Testing machine, a product of the Riehle Bros. Testing Machine Company, 1424 Philadelphia, Pa.

Logical load distribution is attained by the "Tripod" principle—in which each of the three screws takes its share of the load. The apex of the triangle faces the operator, placing the specimen within his sight and reach.

Wall Tie and Spreader Economical Device

Sure Grip wall tie and spreader, developed by the Dayton Sure Grip and Shore Company, Dayton, Ohio, eliminates the use of wood spreaders, buying and forming of wire, twisting of wire, nailing of forms and one-half the studding formerly required.



It is claimed that comparative costs, obtained from several prominent users, show a saving in wall centering costs and wrecking with their use, of approximately $1.50 per lineal foot of wall erected. The device is made to fit any size wall from 6 to 60 inches.

Electric Saw Has Ample Safety Provisions

Safety in operation was the prime consideration in the minds of the designers of the Wallace saw, a recent addition to the group of Wallace portable machines. The guard is locked in a position which covers the blades at all points. For cutting, the operator releases the safety guard by means of a trigger near the grip. When the cut is finished and the saw is lifted from the work, the safety guard or shoe automatically drops and locks in position. The shoe covers the blade and will not open again until released by the trigger.

One handle is of the type found on hand saws; the other is the same as that used in guiding a hand plane. The J. D. Wallace Company, Chicago, manufactures the saw.

With the Manufacturers

New Equipment

(Continued)

3-in-1 Paint Spray for Fine Work

The Alexander Milburn Company, Baltimore, Maryland, has developed a 3-in-1 spray gun which is adaptable to finer and more painstaking painting jobs. This is a triple purpose gun for use either as a siphon-feed, pressure-feed, or gravity-feed spray. It is immediately adaptable to use by any method, whichever may be most convenient for the work.

The multiple-head adjustment permits either a flat, fan spray in either horizontal or vertical position or a round spray by a mere adjustment. The atomization is so fine and even that "orange-peel" is eliminated, minimizing sanding and rubbing. The Milburn spray can be so finely adjusted that it can be used for touching up, shading and high lighting. An air pocket, formed by the fan-shaped nozzle, completely surrounds the atomized spray and lessens the loss of material through evaporation.

Notes from the Field

Genfire New Name

The Genfire Steel Company is the new name of the *General Fireproofing Products*, Youngstown, Ohio. The change was made merely to avoid confusion with a firm of a somewhat similar name in Youngstown. Officers, personnel, policies and products remain the same.

Celite Engineers

The Celite Products Company announce the appointment of *Clyde E. Beckett* and *George S. Holland* as additions to the engineering staff of the Concrete department at the Chicago office.

Lakewood Agents

The Lakewood Engineering Company announces the appointment of *The T. J. Lane Equipment Company*, Springfield, Ohio, as agents for its complete line in the central Ohio territory.

Taylor-Winfield Merger

The Taylor Welder Company, the Winfield Electric Company and the *Winfield Manufacturing Company*, Warren, Ohio, have been consolidated into one organization, to be known as the *Taylor-Winfield Corporation*.

INDUSTRIAL LITERATURE

New Water Measurer

A new water measuring tank is announced by the *Construction Machinery Company*, Waterloo, Iowa, in a catalog of *Wonder* equipment. The tank is described as being extremely simple, with no complicated mechanisms.

House Plans

"Beautiful Homes of Concrete Masonry" is a *Portland Cement Association* booklet containing illustrations, details and floor plans of forty-one residences.

"Milcor" Lath

A new product of the *Milwaukee Corrugating Company*, Milwaukee, Wisconsin, is described in a 16-page book on "Milcor" reinforcing rib lath. This is *Catalog No. 20-D*, supplementing the 1927 edition of the manual.

Mixer Blue Prints

Blue prints and specifications of 14S, 21S and 28S *Jaeger* non-tilting mixers are given in *Booklet No.* 127 published by the *Jaeger Machine Company*, Columbus, Ohio.

Welding Literature

"Long Pipe Lines with Oxwelded Joints," is a booklet published by the *Linde Air Products Company*, New York City. How welded pipe joints overcome pipe joint troubles is told by photographs and quotations on the subject.

Super Cement Uses

Two-page folders illustrate construction work in which *Super Cement* was used to secure water tightness. Copies are available from *Super Cement* distributors or the *Super Cement Company*, Detroit.

"T" Head Folder

Ready-to-use "T" and "L" heads are described in a four-page folder published by the *Universal Form Clamp Company*, Chicago. Form clamps for overhead forms are illustrated in another similar publication.

Chemical Tests Bulletin

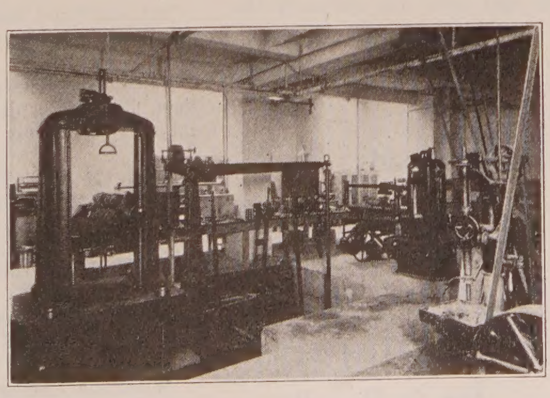
The chemical action of alkali on hydraulic cements is the subject of a 56-page illustrated bulletin (No. 74) published by the *Iowa Engineering Experiment Station.* Experiments were carried out on portland cement and high alumina cement, using magnesium sulphate, magnesium chloride, sodium sulphate, sodium chloride and sodium bi-carbonate solutions. It was found that a magnesium sulphate solution had the greatest destructive action on concrete and next to that, sodium sulphate. Copies will be supplied upon request.

Concrete Placer Bulletin

A bulletin giving complete information on placing concrete pneumatically has been published by the *Ransome Concrete Machinery Company*, of Dunellen, N. J. The bulletin describes the theory of concrete-handling by compressed air, starting with the discovery by John H. McMichael, the inventor.

Another section of the bulletin is devoted to different types of pneumatic placers—the horizontal, and both the McMichael and Ransome types of vertical placers. The last section of the bulletin is devoted to pneumatic grouting, with descriptions of the uses of grout mixers and placers.

Large Testing Machine Installed in South by P. T. L. Branch



The Birmingham, Alabama, branch of the *Pittsburgh Testing Laboratory* has taken larger quarters in the Phoenix Building, where a new 400,000 lb. *Riehle* testing machine has been installed. This machine is said to be the largest commercial laboratory testing machine in the South and makes the P. T. L. branch one of the most complete laboratories below the Mason and Dixon line.

Mixer Musings

Reported by "Joe"—The Mixer Boss.

Si, Si, Senor!

Matillas, Guadalajara, Spain.
14th June, 1927.

Dear Joe:

Even in sunny Spain, the land of "tomorrow," we have heard of you, and your Guild of Certified Slump Testers. I wish to become a member of the Guild.

My first experience with the slump test was last June. I designed a mix, using Prof. D. Abrams' water-cement ratio and fineness modulus tables, to give 2000 lbs. at 28 days with a slump of 3 to 4 inches. Results—slumps of 2.5 inches to 3.5 inches and an average compressive strength on a 2¾-inch cube at 28 days of 2700 lbs. and 1900 lbs. at 7 days. This mix was made with our own cement, which naturally I, as plant chemist, believe is as good as the best in Spain, and we make some good cements here.

I have made many other slump tests since I made my first, and find our cement can be relied upon to give the specified 28-day strength after only 7 days. I am all for slump tests, but believe it will be many a day before slump tests are general on concrete construction work in Spain; we move slowly. Of course all smallish jobs are hand mixed and I am afraid the workman controls the water-cement ratio, with naturally poor results.

If you honor me with membership would you please forward the certificate to me at

154 Alexandra Rd.,
St. Johns Wood, London, N. W. 8,
England.

I hope to arrive some time this year in the U. S. A. I have now been over 14 months on the waiting list for a quota number to enter your wonderful country, where I hope to be able to obtain a position in the cement industry.

Keep to your good work, Joe, preach 'em good concrete, and still more good concrete, and nothing else but good concrete.

Yours always truly,
(Signed) *Alan Jackson.*

Dumb of the Mayor

Mayor: "The public library you built is falling to pieces! What kind of mortar did you use between the bricks, anyway?"

Contractor: "Why, I didn't use mortar! I used library paste, of course!"—*Exchange.*

Argument for Hard Roads

A Farmer in the South came to town a few weeks ago with a load of cotton. "Do you know," he remarked as he stood near the newly opened concrete highway, "I made the trip in a little under two hours this morning. It used to take me two days and a couple of plugs of chewing tobacco. This morning I made it with one chew."—*Exchange.*

Joe, the Mixer Boss.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 West Thirty-ninth St., New York City.

American Road Builders' Association; Chas. M. Babcock, President, Miss E. A. Birchland, Secretary, 29 W. 39th St., New York City.

American Society for Testing Materials, C. L. Warwick, Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; D. H. Sawyer Secretary, 1150 Munsey Bldg., Washington, D. C.

Associated Metal Lath Manufacturers; 123 West Madison St., Chicago; Wharton Clay, Commissioner.

Building Officials Conference of America: H. E. Plummer, President, Fred W. Lumis, City Hall, Springfield, Mass., Secretary.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.

Concrete Products Association; S. I. Crew, President, Norwood, Ohio; Austin Crabbs, Secretary, Box 343, Davenport, Iowa.

Iowa Concrete Products Association; Floyd Goodrich, President; R. L. Gavin, Secretary-Treasurer, 405 Hubbell Bldg., Des Moines, Iowa.

National Association of Building Trades Employers; A. E. Coleman, President; A. W. Dickson, Executive Secretary. 2226 Builders Building, Chicago, Illinois.

National Association of Builders' Exchanges; William F. Chew, Baltimore, President; Earl F. Stokes, Secretary, 15 East Fayette St., Baltimore, Md.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 East Twenty-second St., New York City.

The National Lime Association: G. B. Arthur, Secretary, 927 15th Street, N. W., Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 933 Leader-News Building, Cleveland, Ohio.

National Sand and Gravel Association, V. P. Ahearn, Executive Secretary, 432 Munsey Bldg., Washington, D. C.

Nebraska Concrete Products Association; A. V. Anderson, President, Reimers-Kaufman Co., Lincoln, Neb.; E. L. Bateman, Secretary, Bethany, Neb.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

Portland Cement Association; William M. Kinney, General Manager, 33 West Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, Builders' Bldg., 228 N. La Salle St., Chicago, Ill.

Wisconsin Concrete Products Association; A. P. Kuranz, Secretary-Treasurer, 425 E. Water St., Milwaukee.